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ABSTRACT

Guidelines are presented for applying cost-effectiveness and cost-benefit analysis techniques to nonformal education (NFE) programs in developing nations. The methods are based on workshops conducted in Kenya, Tanzania, Indonesia, and Guatemala. The manual is designed for those personnel responsible for planning, administering, and evaluating NFE programs, and government or private agency officials who make investment decisions. The manual is intended as a guide, and is organized as follows: economic analysis in project selection, development, and evaluation; organizing for economic analysis: concepts in economic analysis of NFE; step-by-step procedures--including defining the project and stating objectives, listing resources, determining and adjusting resource costs, summarizing and analyzing project costs, specifying educational outcomes and skills to develop, specifying intended and unintended proect outcomes, valuing and adjusting project outcomes, relating costs and outcomes, and interpreting results of the analysis; report writing: information processing: and use of computer-based information systems. Examples and exercises are included in the manual, and explanations of statistical methods and concepts are appended. (MH)

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A MANUAL FOR THE ANALYSIS OF COSTS AND OUTCOMES IN NONFORMAL EDUCATION

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A MANUAL FOR THE ANALYSIS OF COSTS AND OUTCOMES IN NONFORMAL EDUCATION

1979

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SECTION A

INTRODUCTION

ABOUT THIS MANUAL AND HOW TO USE IT

What do you do with your money...when you haven't got much money? That will be the central question in the minds of those who use this manual. Economists call it the allocation of scarce resources. So do the harried officials in developing countries who are trying to meet infinite educational needs with finite educational budgets.

This manual is one product of a three-year study by the International Office of the Educational Testing Service (ETS) concerning costs and outcomes in nonformal education. The study, funded by the United States Agency for International Development, is designed to see how far we can go in applying the techniques of cost-effectiveness analysis and cost-benefit analysis to the elusive business of nonformal education.

We will not take time here to dwell on definitions of nonformal education. We are referring to organized educational activities for children and adults which are conducted outside the formal school system, outside the classroom. Readers may find out more about nonformal education in developing countries in Brembeck and Thompson (1973), Case and Niehoff (1976), Coombs and Ahmed (1974), Harbison (1973), Sheffield and Diejomaah (1972), and Grandstaff (1974).

This manual is for practitioners. From the beginning, we have tried to keep an applied and practical perspective. Our objective is not the development of theory or new models for economic analysis. Rather, we are presenting what is known about cost-effectiveness and cost-benefit analysis for people who are responsible for planning, administering, and evaluating nonformal education projects in less developed countries. We hope the manual will help local people to obtain a better understanding and a better assessment of local work.

"Projects: The 'Cutting Edge' of Development"

"Projects: The 'Cutting Edge' of Development" was a phrase used by J. Price Gittinger of the World Bank in his highly readable book, Economic Analysis of Agricultural Projects (1972). Like Gittinger, we believe project design and evaluation are crucial in development and we have chosen "the project" as the unit to which the procedures in this manual are addressed. We also agree with Gittinger that "in most countries the capacity to prepare and analyze projects lags"(p.1). We are hopeful that the knowledge contained in this manual will be of some value to those who have the difficult job of choosing between educational projects and, later, taking responsibility for their effectiveness.

Economists and Projects

One problem in developing this kind of manual is the gap that exists between economic analysts and project administrators in their professional backgrounds, language, and resources. The economist approaches costs and benefits with economic theory, with econometric techniques, and with the capabilities of modern data processing.

On the other hand, the administrator, with day-to-day responsibility for the management and success of projects, has to devote his or her energies to organizing skills and materials to move towards project objectives. There is little time for research. Assuming that both parties are truly interested in comparing the merits of individual projects, the question is: can the cost-benefit approach developed by economists be streamlined and simplified to be useful to project managers who have limited time and resources for economic analysis? We believe this question will be answered affirmatively and that the present manual represents a step in that direction.

Nonformal Education

A second major problem lies in the nature of "nonformal education," NFE for short. NFE includes an enormous range of educational activities for children and adults, activities related to training in literacy and numerical ability, agriculture, family planning, public health and child care, handicrafts, job skills -- a great variety of things.

Some of the characteristics of nonformal education make it difficult to apply conventional methods of economic analysis, as the following chart illustrates:

	Characteristics of Nonformal Education	Implications in Analyzing Nonformal Education
1.	Projects often have several organizations or client groups responsible for their financing or management.	There are varied needs and perspectives in making decisions. There are multiple and sometimes conflicting goals and objectives.
2.	Many projects are designed for small groups and are remote from urban centers.	Money and skill for getting information and for analysis may be limited. There may be minimal support from outside for analysis and research.
3.	Information and data about the target group or area are often widely scattered, not inventoried, difficult to obtain.	It can be difficult to describe project aims and activities, the resources used, and project outcomes, in a systematic and accurate manner.
4.	The emphasis may be on non-monetary objectives such as a more equitable distribution of food, income, social and health services.	It is difficult to measure systematically some nonmonetary outcomes.
5.	The emphasis may be on the immediate and practical results of the educational activity, i.e., many projects are designed to meet the economic or social needs of target groups or areas.	There can be a wide diversity in project outcomes. It can be difficult to see relationships between project outcomes and the interrelated factors which influence outcomes.

Of course, not all nonformal education projects have all these characteristics. But they are common enough to be considered seriously when one designs a project analysis in the field. There are too many difficulties in nonformal education, and its analysis, for anyone to think that this manual offers neat methods for analyzing costs and outcomes in every case.

Analysis of Costs and Outcomes: SCOPE

In order not to have to repeat the phrase "methods for determining cost-effectiveness and cost-benefits in nonformal education" throughout this manual, we have used the acronym SCOPE, which stands for:

Specification of
Costs and
Outcomes in
Project
Evaluation

SCOPE is not really something new, it is an organized presentation of some of the things that have been learned in the field about the economic analysis of nonformal education. As Marlaine Lockheed and Kan Young (1977) said in a state-of-the-art paper written for this project, "Perhaps what is needed most at this time is to apply in practice the procedures recommended by Dean Jamison (of the World Bank) and others in order to test, refine, and simplify using data generated by ongoing projects in nonformal education" (p.6).

WHAT SCOPE DOES

SCOPE provides relatively simple, step-by-step procedures for the economic analysis of NFE projects in lesser developed countries.

SCOPE is flexible enough to be used under actual project conditions, especially in regions where data are scarce.

SCOPE aids in the analysis of projects with attention to project description, the choice of techniques for collecting and analyzing data, and the resources required for this analysis.

Who Uses SCOPE

Those who might find SCOPE valuable include:

1. Planners and managers of NFE projects
2. Field technicians responsible for project analysis
3. University or government staff who provide expertise in project appraisal
4. Staff of ministries or private agencies who make investment decisions from field data.

What is SCOPE Like

1. It uses simple and inexpensive methods.
2. It relies upon the creativity of the analyst and his knowledge of the project and the project environment.
3. It deals with the minimum data necessary to assess the merits of a particular project.
4. It provides a means of working with costs and outcomes in an overall conceptual framework.

5. It directs the analyst's attention to information required about the relationships between project inputs and outputs.
6. It offers an appropriate set of procedures for collecting data.
7. It examines whether a project is cost-effective or not, and helps explain the reasons.

More About the Manual

This is not a cookbook and you won't find any sure-fire recipes here for making a cost/benefit analysis when the ingredients are nonformal education. The manual points the way; it gives readers the basic techniques for this kind of economic analysis; and it illustrates, with many examples, how to calculate costs and how to identify and measure outcomes. That is about as far as the state-of-the-art permits us to go.

In the manual, you will not encounter complex mathematics. Similarly, you will not find much theory because the emphasis is on the mechanics of analysis.

As indicated above, we have selected relatively small projects as the focus for this work. Cases and examples are used frequently to make things clear. There are exercises, and references, for those who want to become highly proficient in the analysis of costs and outcomes in nonformal education.

With regard to the organization of the manual, the next section (Section B) has two parts: 1) Economic Analysis in Project Selection, Development, and Evaluation, and 2) Organizing for Economic Analysis.

Section C presents the basic logic which underlies analysis of costs and outcomes, and a number of examples. We assume many readers have had no formal training in this field so concepts and vocabulary are provided in Section C as preparation for the application of the step-by-step procedures which are described in Section D.

Pretesting and Improving the Manual

An earlier version of the manual was pretested in 1978 in four workshops which ETS conducted on behalf of USAID in Kenya, Tanzania, Indonesia, and Guatemala (in Spanish). A fifth workshop was conducted by ETS in the United States.

Workshop participants provided a great many suggestions, in discussion and in writing, for improving the manual. Most of these improvements have been incorporated in this version.

Credit Where Credit is Due

The principal authors and editors of this manual are Victor Levine (economist), Joyce Lewinger Moock (anthropologist)*, Dean Nielsen (development educator), Susan Sargen (economist), and John Summerskill (educational administrator and director of the project). James Emery (president of EDUCOM) wrote the material on storage and retrieval of data.

Several sections of the manual are based on earlier work by three others associated with the project: Sam Ball (psychologist), Marlaine Lockheed (sociologist), and Kan-Hua Young (economist).

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Throughout the project, we received advice and assistance from officers of USAID, especially: William Charleson, James Hoxeng, Ray San Giovanni, Richard Shortlidge, and Bernard Wilder.

Two economists with the World Bank made significant contributions to the project: Dean Jamison (formerly with ETS) and Charlotte Jones (formerly with USAID).

We are especially indebted to the institutions which co-sponsored the workshops and provided crucial local assistance: East African Examinations Council, Nairobi, Kenya; Institute for Adult Education, Dar es Salaam, Tanzania; BP3K, Office of Educational and Cultural Research and Development, Jakarta, Indonesia; Junta Nacional Escolar, Guatemala City, Guatemala. A workshop in the United States was sponsored by the Foreign Scholars Summer Program at ETS.

Many skilled persons took part in the preparation of manuscripts, assembling earlier versions, revising, editing, printing, and shipping. We thank Barbara Cohen, Rosemary Lanes, Veronica Morris, Audrey Staats, Michael Walter, and everyone else.

SECTION B1

ECONOMIC ANALYSIS IN PROJECT SELECTION, DEVELOPMENT AND EVALUATION

Administrators in developing countries must often navigate without a map. A continuing and widespread problem is the lack of useful, reliable information about development programs and their consequences. In many situations, we simply do not know what is the best action to take and how the action will affect the people who are supposed to benefit -- farmers, parents, patients, or students.

In the last decade there has been an expanding effort to build into development projects procedures which will produce sound information for project planning and management. More and more, the multilateral donor agencies, and the bilateral donor agencies, ask for such procedures in project planning and evaluation. Naturally, donors want to know about project plans, what are expected outcomes, and predicted returns on investment. Later they will want to know if the stated goals of the project were met and if the project paid off as predicted.

These are crucial questions for officials in less developed countries where resources are scarce and an investment in Project A often means no investment in Project B. For example, a decision to wage a major campaign against illiteracy among adults may mean that the country cannot catch up on the shortage of primary school classrooms in the foreseeable future, or vice versa. These are tough decisions affecting the lives of many people, and planners in less developed countries need all the sound information that is available. This manual provides concepts and procedures for getting better information about development projects. We believe that the planners, administrators, or evaluators who master these concepts and procedures will do a better job because they are better informed.

The focus in this manual is economic analysis. We are primarily concerned with the practical questions of whether or not a particular project is worthwhile from an economic standpoint. As Irving Sirken (1977) wrote in some excellent training materials prepared for the World Bank's Economic Development Institute: "Cost/benefit analysis can be regarded as an approach to decision-making. It tries to add up and compare the costs and benefits (to the extent that numerical addition and comparison is possible) of doing particular things in particular ways at particular times and places. CBA, in one sense, is nothing more than the application of rationality to decision-making, as opposed to relying entirely on intuition..."(Ch. XI,p.1)

Now, don't get us wrong about this. We are not saying that decisions about development projects are made, or should be made, just because the economic consequences are good or bad. Obviously, there are other important considerations in making a decision about beginning, continuing, or ending a project. Thus, educational projects may be initiated in a particular locale for predominately political reasons and in other parts of the country for predominately humanitarian reasons. Quoting Mr. Sirken again on cost/benefit analysis: "...it cannot and should not be the sole basis for decision-making But it can be a valuable aid to decision-making in combination with other elements." (Ch. XI, p.2)

Economic analysis of projects can be important at three points in time:

1. When a project is being considered for funding and implementation, i.e., project selection.
2. When a project is underway and improvements are being considered, i.e., project development.
3. When a project is being considered for continuation or replication, i.e., project evaluation.

A. ECONOMIC ANALYSIS IN PROJECT SELECTION

When many projects are under consideration and the problem is to choose among them, cost/benefit analysis is especially useful. In essence, the analyst looks at one or more alternative project plans and compares the cost with the benefits to determine which promises to be the best investment.

If the problem is not to select among alternatives but to identify those which are most worthwhile, economic analysis can help to highlight unreasonable investments or those which detract from broader development goals.

Analysis conducted prior to the implementation of an NFE project attempts to predict what will happen and to assign values to the projected costs and outcomes.

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Economic analysis during project selection allows us to answer such questions as:

1. Which project(s) should be implemented or funded?
2. Is this project compatible with national development goals and one which promises to be a profitable investment?

B. ECONOMIC ANALYSIS IN PROJECT DEVELOPMENT

Analysis of costs and outcomes also can be valuable during the development phase of a project. For example, with the procedures described in this manual, we can calculate what additional benefits will accrue in an NFE project if we invest in 40 vs. 20 instructors to teach sewing machine operators; in 500 vs. 200 sewing machines; in 5 vs. 3 training centers. We can also calculate what additional economic cost will be involved with these different arrangements and, consequently, what distribution of our resources is likely to bring the best return on investment.

Project analysis which allows us to make mid-course corrections during the implementation process is sometimes called formative evaluation. Such evaluation results can be fed back to the persons managing the project so that the project can be improved as it goes along. Economic analysis during project development can help show how the efficiency of the project can be improved.

C. ECONOMIC ANALYSIS IN EVALUATION

Economic analysis, in addition, can be conducted on projects which have been in operation for some period of time or which have been terminated. This is called summative evaluation and its purpose is to determine how the project turned out, what was accomplished in total. However, just because such analysis looks "backward" it may still be related to decision-making. An evaluation that is conducted after a project has been in operation for some time might help with decisions regarding the continuation, expansion, or replication of the project. Moreover, examination of ongoing or completed projects offers the best guidelines for planning subsequent projects and, again, investing scarce resources. Here experience is, indeed, the best teacher, if one can get hold of experience in some systematic and objective fashion.

Economic analysis for summative evaluations allows us to answer such questions as:

Was this project a profitable investment?
Should it be expanded?
Should it be continued?
Should it be replicated in other areas?
Was it a better investment than some alternative activity?

See Example 1, Evaluation for Better Project Management, which illustrates how formative and summative evaluations can fit into a project design.

D. COST/EFFECTIVENESS VS. COST/BENEFIT ANALYSIS

Economic analysis is a comparison of costs and outcomes within projects and between projects. This type of analysis, as opposed to other forms of evaluation, leads us to think of NFE as an investment. As such, it can provide the tools for comparing returns on a given use of resources and alternative ways of achieving similar outcomes. In this manual, we talk about two types of economic analysis: the cost/effectiveness approach and the cost/benefit approach.

When we look at a project in terms of cost/effectiveness or cost/benefits we are interested, in both cases, in the costs of all the resources put into the project in relation to the outcomes of the project. However, while both cost/effectiveness analysis and cost/benefit analysis are concerned with the comparison of costs and outcomes, the units of measurement differ. A cost/effectiveness analysis is used in cases in which the outcomes cannot be expressed in monetary terms because of the absence of suitable market prices. Most studies of the economics of education focus on effectiveness, rather than benefit, as the output is typically some measure of learning such as test scores.

Only when monetary prices exist for an output quantity can cost/benefit analysis be performed. Then the value of all cost items can be compared with the value of all benefit items. In the cost/benefit approach we can assign a monetary value to each of the outcomes and determine a single dollar value for the total economic output of the project. This approach allows us to compare dissimilar projects and to select the one which, on an economic basis, is the best investment.

Cost/effectiveness analysis, on the other hand, provides no insight into the relative merits of projects which can be expected to have dissimilar outcomes. A cost/effectiveness approach will allow us to select among projects, or among project arrangements, for a given level of educational achievement which can be attributed to the project.

See Example 2, which gives a simplified illustration of cost/effectiveness and cost/benefit approaches.

Example 1

EVALUATION FOR BETTER PROJECT MANAGEMENT

1. The Government of Ruritania decided to initiate nonformal education for adults in three agricultural provinces.

2. The Ministry of Education spelled out the objectives of the program and the expected gains in adult literacy and numerical skill, and in agricultural (maize) production.

3. The Ministry also developed a detailed educational plan including actions to be taken, a schedule, resources (staff, facilities, materials), and a budget.

4. The Government of Ruritania submitted the plan to an international donor agency and funding for the program was approved in the next five year loan agreement.

5. The plan called for a formative evaluation to be carried out at the end of Year I and Year III of the project so that it could be improved as it proceeded. The project management kept track of all resources put into nonformal education and measured changes in literacy, numerical skill, and maize production among the adult target groups.

6. A summative evaluation was conducted in Year V so the Government of Ruritania and the donor agency knew what had been accomplished.

Example 2

COST/EFFECTIVENESS

The Government of Ruritania has now completed three years of nonformal education for adults in three rural provinces. The Year III evaluation showed that approximately the same percent of adults in each province stayed in the program and attained functional literacy. However, for a number of reasons, total costs varied as follows: Province A -- $48 per trainee; Province B -- $14; Province C -- $23. Clearly the program in B was the most cost-effective and the program in A the least cost-effective.

COST/BENEFIT

The evaluation carried out for the Government of Ruritania also showed that the value of increased maize production in the three provinces which can be attributed to the three years of nonformal education amounted to $1 million. The total cost of demonstrations and instructional materials for farmers was $800,000 -- with both figures adjusted for changing monetary values over time. Thus, the benefit over cost ratio, to this point in time, is clearly favorable.

EXERCISE 1:

NONFORMAL EDUCATION IN LABU

National elections have just been held in Labu and Robinson Stevens is the new President. During the campaign, he promised repeatedly that all adults in Labu would learn to read and write the national language. President Stevens has moved quickly to make good on this promise and has appointed Mrs. Mary Alotu, a dynamic leader, as the new Minister of Education.

Labu island has about 2 million people, and some 400,000 of them live in Labu City. About half the children in the 7 to 12 age group are now in primary school, but the schools are heavily concentrated in the capital and secondary cities. It is estimated that at least 500,000 adults, mostly in rural areas, do not have basic reading and writing skills.

To make matters worse, the rate of population growth in Labu is high so that enrollment in primary schools doubled from 1946 to 1970. But it is expected to double again in this decade, from 360,000 in 1970 to 600,000 in 1979. Without adequate resources for public schooling, the number of illiterate youth reaching adulthood increases yearly.

With knowledge of these facts, President Stevens and Mrs. Alotu quickly agreed, as the confidential minutes of their meeting said: "There is no conceivable way to double the education budget over the next 20 years and to keep pace -- and no more than keep pace -- with the increase in illiteracy among Labu citizens."

EXERCISE 1: NONFORMAL EDUCATION IN LABU (CONTINUED)

From the outset, President Robinson Stevens laid down some guiding principles for an adult literacy program: the program should be as flexible as possible; solutions should be as simple and practical as possible; the objective should be better learning results for the largest number of adults at a minimum cost per participant.

Mary Alotu, Minister of Education, proposed that two innovations be introduced as quickly as possible, on an experimental basis, both designed to increased the number of adults per teacher. The first experiment would make use of learning modules for self-instruction which had been developed (and used with enthusiasm) in a neighboring country with similar problems. This program, called FORWARD, will be tried in three Labu communities to supplement formal teaching and, hopefully, to increase enrollments without adding teachers.

Next, instruction by radio will be introduced in five districts surrounding Labu's second largest city, New Hope. In Project NEW HOPE, 150 twenty-minute programs will be developed and broadcast for level one literacy and 165 lessons of similar length for level two literacy. As with FORWARD, programs will be borrowed from other countries, adapted, and translated -- wherever possible.

After three years, a decision will be made about extending projects FORWARD and/or NEW HOPE to other parts of Labu.

DISCUSSION QUESTIONS: NONFORMAL EDUCATION IN LABU

1. Before Projects NEW HOPE and FORWARD were announced, Dr. Colin Bolewa, Director of Planning and Evaluation in the Ministry of Education, was working day and night on alternate proposals for Mrs. Alotu. For instance, a proposal to introduce educational television in New Hope, instead of radio, was studied and rejected. If you had been in Dr. Bolewa's position...

   - how would you have conducted the study predicting costs and outcomes for instruction by radio vs. TV?
   - how would you study NEW HOPE vs. FORWARD in terms of expected costs and outcomes?

2. Dr. Bolewa was also asked to provide a plan for a formative evaluation at the mid-point of both projects and a summative evaluation at the end of three years. So, Dr. Bolewa,...

   - what would be your plan for the formative evaluation? for the summative evaluation?
   - would you be conducting cost/effectiveness studies or cost/benefit studies?
   - how would you measure or estimate outcomes?
   - how would you account for all the costs involved?
   - what would you do about the different numbers of participants in the two projects?
   - how would you draw your conclusions as the projects neared completion?

SECTION B2

ORGANIZING FOR ECONOMIC ANALYSIS

If it is a good idea to assess costs and outcomes in nonformal education, it won't happen by itself! Someone has to make a plan and do the work.

A. WHO'S IN CHARGE?

It's no secret: the attitude of the person in charge of a project is very important. If the person in charge really cares about the project, he or she will want to know what is going on and will keep track of the project. He will want to know what his options are, how to improve the project as it moves along, and he will want to know the results of the project and the costs. It makes sense, then, to select and train project managers who know how to analyze project costs and outcomes.

B. GETTING READY

The most common error in project analysis is beginning the process too late. Someone has to think about procedures for project planning, development, and evaluation as soon as possible -- when the idea of the project is first being explored. Obviously, analysis for project selection or project development must be initiated early. Such analysis is a forward-looking, planning tool.

Problems occur in final or summative evaluations if they are not planned early and built into the project. Catherine Crone of World Education (1977) wrote:

> All too often, thinking about the final evaluation is left until the project is about to end. We find ourselves then in the untenable position of being able to describe how things are now that it is over, but having to guess how they were at the beginning (p.6).

No matter how sophisticated the analytic techniques which are used, an economic analysis is only as good as the data on which it is built.

30

In addition to careful documentation about the project itself, we need sound information about the participants and their environment at the time the project begins. This information forms a base from which we calculate and interpret changes which have taken place in the course of the project. This initial information about project participants -- where they come from, what they know about written language or farm practice, or family planning, or whatever -- is called baseline information.

Deciding what baseline information to obtain before the project begins takes foresight and judgment. Later, we deal with the kinds of cost data and cost estimates that should be considered in nonformal education. We will also talk about the assessment of outcomes and attaching monetary values to outcomes whenever possible. But in organizing an economic analysis, we must realize that the important questions to ask at the end of a project largely determine what must be asked at the beginning.

To illustrate, let us say there is a rural health campaign to introduce more protein into infant diets. The goal is to reduce infant morbidity and mortality by educating mothers about available foods with high protein content. At the end of the campaign, infant morbidity and mortality will be gauged. But unless we measured the same things at the beginning we will not know whether the educational campaign made a difference or not.

Catherine Crone (1977) summarizes: "The reason for making some decisions about the final evaluation at the outset is to ensure that comparable data are collected at the beginning of the project and at the end."(p.6)

C. WHO DOES THE ANALYSIS?

Good project analysts may be made in heaven, but you still have to find them. Does one look inside the project or outside?

Our answer to this question is that it depends on the reason for the analysis; whether the analysis is for planning and developing the project, or for deciding whether to continue or terminate the project.

Michael Scriven (1974) wrote about this in a useful book entitled Evaluation: A Study Guide for Administrators. He said: "There are two considerations that should be taken into account when looking for an evaluator and they do not always point in the same direction. We can refer to them as credibility and validity" (p.65), that is, whether the evaluator will be believed and whether the evaluation will be correct. Scriven observed that if it is a summative evaluation, to demonstrate accountability to a critical external audience, "it would be fatal to use as an evaluator someone who is the brother of the project director or the wife of the district superintendent"(p.65). A Tanzanian project manager made the same point in a workshop: "If it's a town football match you can use your own referee; if it's the national championships you better get someone from the outside."

Nevertheless, an internal evaluator who is part of the project staff, and works on the project daily, has a great deal to offer. The internal evaluator:

- provides continuous feedback on performance
- avoids disrupting the project
- understands cultural considerations
- adjusts to the local setting
- focuses on the pressing problems
- encourages adoption of improvements.

So...if you select an external analyst, you may get a person with more competence, more objectivity, and less vested interest in the project. On the other hand, the external analyst may take longer to understand the project, take longer to communicate with staff, and may always be regarded as an outsider.

If you select an internal analyst, you may get a person who is much more familiar with the project and who has good working relationships with the staff. On the other hand, the internal analyst may not have enough objectivity, enough time, or enough skills to do the job.

You can see that this manual is going to leave the selection of evaluators, external or internal, entirely in your hands.

But there is some further advice that we can pass along. Writing about rural development in East Africa, Chambers (1974) says that evaluators must be flexible and "this in turn implies a non-routine, innovative, and sensitive performance ... But more than this, it requires common sense; a sense of what is practicable, and good judgment if the evaluator is to make the leap from the exposition of facts to the presentation of good judgment recommendations"(p. 124).

On the selection of evaluators Professor Scriven (1974) addresses another factor of considerable importance: "The use of external evaluators is likely to be threatening to project staff and, quite apart from the lack of familiarity, this may lead to considerable difficulty in getting hold of the required information, especially if it is in any way 'sensitive,' i.e., recognized as likely to be usable for supporting complaints and possibly recommendations for dismissal, etc."(p 67).

Finally, Kinsey (1978) makes an observation which seems particularly pertinent in the analysis of nonformal education:

> ...evaluators are accustomed to get guidance from, and report to, the top decision makers in a program. Some nonformal education programs, however, are philosophically -- and sometimes practically as well -- committed to a bottom-up or participatory approach where initiative is encouraged from participants, where the program is to be responsive to expressed participant needs, and "teachers" are viewed as learning facilitators. Here the traditional evaluator's stance tends to be incongruent with the philosophy, and unless adapted will cause reactions ranging from opposition to outright rejection by both staff and participants (p.5).

So ... who does the analysis? Someone has to make the selection, and here, in summary, are some factors that have to be taken into account:

SOME MAJOR CONSIDERATIONS
IN SELECTING A PROJECT ANALYST

External analysts may have more credibility with external authorities and sponsors.

External analysts may have difficulties getting needed data.

Internal analysts may have more to contribute to the development of projects.

Internal analysts may be more valuable in nonformal education with a participatory approach.

Any analysts must have good sense and judgment.

D. COSTS OF EVALUATION

No doubt about it: evaluations cost money.

Evaluation costs should be included in project budgets from the outset. Later sections of this manual will indicate the necessity of taking into account all resources required to carry out a project, such as staff time, facilities, materials, administrative overhead, and so on. There is no point in fooling ourselves about the cost of projects, including evaluation costs.

But evaluations also produce benefits and, as shown later in the manual, monetary values can be ascribed to those benefits. For example, a formative evaluation may find that some project staff are not productively employed and by shifting them to teaching positions the project overhead costs can be significantly reduced. Or, to take another example, a summative evaluation may demonstrate that the costs of informal education for farmers are more than offset by the value of increased crop yields. BEWARE! Sometimes plans for evaluating a project are unrealistic and needlessly expensive. Sometimes the people planning the evaluation get carried away and, as Americans say, "the tail is wagging the dog." Catherine Crone (1977) wrote about this, too, and she advocated keeping project analysis to the point: "Not everything can be answered. To try to do so would be foolish. Evaluation costs money and takes time; trying to answer all the questions would mean that members of the staff would be spending all of their time collecting data instead of running the program"(p.5).

There are no fixed rules about the proportion of project costs which should be set aside for evaluation. Obviously the costs of evaluation will depend upon the size and complexity of the project, whether it is experimental or established, whether the evaluators are imported, and many other factors. Some experienced evaluators suggest that 10% of project costs may be required for an evaluation to be sound and useful. If the proposed costs of evaluation are higher than 10%, the project administrators should take a critical look at the evaluation plan.

EXERCISE 1

SCENE 1: MINISTRY OF AGRICULTURE, REPUBLIC OF TERRA RICA

Doctor Raphael Mendoso, Minister of Agriculture (MOA); Mr. Salvador Garcia, Deputy Minister of Agriculture (DEP); Dr. Mercedes Diaz, Assistant Minister for Planning and Research (ASST).

MOA: Good morning! Good morning!

DEP: Good morning, Excellency.

ASST: Good morning, Dr. Mendoso.

MOA: I want to discuss the nonformal education project. The loan agreement with the Intercontinental Development Bank is nearly complete. Who is going to be project manager?

DEP: We want to recommend Tomaso Lopez, Excellency. Lopez has a farm background, he is an expert in ag extension, and he is very interested in new techniques for getting information to farmers.

MOA: I know Lopez and I agree with you. When can he start on this project?

DEP: As soon as we can find someone else to run the cooperative extension program in the Western Region.

MOA: Well, I want Lopez on the nonformal project immediately. We have some tough decisions to make about how much money to spend on radio education, how much on posters and handouts, how much on more extension staff. We have to have a better idea of what results we can expect and what the pay-off should be.

ASST: I've started to work on the economic analysis, Dr. Mendoso. The planting season is only three months away and if we are going to get baseline information from the farmers in the nonformal program we have to get it soon.

MOA: That's fine, Mercedes, but we need a complete statement of the project objectives -- what this education is supposed to accomplish. We told the Intercontinental Bank maize yields would go up. We better make sure we know how much maize the farmers in the program are growing right now.

ASST: I'll get together with Tomaso Lopez immediately and we'll get all the objectives down on paper with a plan to measure them.

SCENE 2: MINISTRY OF AGRICULTURE, REPUBLIC OF TERRA RICA

(ONE WEEK LATER)

MOA: All right, let's postpone further discussion on the coffee disease problems. How are we doing on the nonformal education project?

ASST: I met with Mr. Lopez, Excellency, and also with Jorge Cantu-Diaz, who is an economist with a good background in statistics.

MOA: An economist who can do arithmetic! A rare species!

DEP: Perhaps we should ask the Conservation Department to protect him.

ASST: Well, we haven't completed our plans for the nonformal project but we have agreed that we want to look at two kinds of outcomes--the information the farmers get from the educational program and the changes which occur in actual farm practice.

MOA: There is something else I want to know--what happens to the attitudes of some of these farmers when they get into an educational program? Are they more likely to change? Will they experiment with new seed varities, with inter-cropping?

ASST: I agree with you, Dr. Mendoso, a progressive attitude may be the most important thing the educational program accomplishes. But changes in attitude are not so easy to measure. We have worked out some indicators for measuring change in the information which farmers have--using questionnaires before and after the nonformal education. And we can inspect farm practices and measure the bags of maize per hectare. We will have to work on a simple method for assessing whether attitudes are more progressive.

DEP: Anyway, you're on the right track with all of this. Keep it simple. We're trying to grow more corn in Terra Rica--the economic analysis is a means, not an end.

MOA: I would like to know who is going to be responsible for the evaluation of the nonformal education project?

ASST: I thought you might appoint young Gomez, sir.

MOA: Who is young Gomez?

ASST: He is my assistant, Dr. Mendoso, and he attended a workshop on evaluation in nonformal education.

MOA: Look, we've got to have an evaluator who knows his business and Gomez may know his business. But others have to believe that evaluator, too. This nonformal project is going to get a lot of attention from the newspapers and the television. The opposition already says it is a boondoggle. When the project is going well I want to know it! And when the project is in trouble I want to know that! And fast, too!

ASST: I understand, Excellency, I'll see who the Research Bureau recommends for the position of evaluator.

SCENE 3 (NEXT DAY): MINISTRY OF AGRICULTURE, REPUBLIC OF TERRA RICA

SECRETARY TO THE MINISTER: It's Mr. Garcia, sir.

MOA: Yes, Garcia, what is it?

DEP: I have two tickets to the dinner for Pele tonight and I thought, if you were free, you might like to go?

MOA: Thank you, but no. Not after he went to play for New York. Anything else on your mind?

DEP: I have been thinking about the evaluation of the nonformal project and...

MOA: So have I. About the evaluation, someone like young Gomez can do a good job technically, with some help from Mercedes Diaz. It will be valid. But credibility is another thing. I have been thinking about asking that retired professor of agriculture economics, Henri Lefevre, to take part in this. He's independent, that's for certain, and he has a good reputation with the crowd at the Intercontinental Bank.

DEP: I met Lefevre only once and I liked him. Working with Gomez we wouldn't have to worry about interpreters, translating reports, and all that business. I think you've got a good idea, Excellency.

MOA: Lefevre is retired, in Geneva, I think, and we could get him to come out for a couple of weeks to work with Gomez on evaluation design. He will want to be in on the analyses of outcomes each year and at the end of the project.

DEP: Do you think the project manager and the staff will accept a foreigner looking over their shoulders?

MOA: It will be all right as long as we're in charge of the project and in charge of the evaluation. Lefevre, by the way, is a very decent chap.

PRESS REPORT: MINISTRY OF AGRICULTURE

REPUBLIC OF TERRA RICA

EL PERIODICO

La Gran Ciudad, Terra Rica -- A new program of nonformal education for the farmers of Terra Rica was announced today by his Excellency, Dr. Raphael Mendoso, Minister of Agriculture.

During the next five years, farmers will receive information on modern farm practices by way of radio, specially designed leaflets and posters, and a new corps of trained extension agents. The program is to be financed with a loan which the Government of Terra Rica has negotiated with the Intercontinental Development Bank.

In announcing the program, Dr. Mendoso told officials attending a reception at the Hilton Hotel: "The nonformal education project has one sweeping objective -- to bring a higher degree of prosperity to our farmers." The Minister said it is anticipated that maize yields will increase by as much as 20 percent where the educational program is successful.

The Ministry of Agriculture has placed Mr. Tomaso Lopez in charge of the new project. Lopez, a product of a farm family, is a specialist in agriculture extension with special knowledge of modern communication techniques for educational purposes.

The total amount of money to be spent on farmer education, under the Bank loan, is 8,500,000 beevels which amounts to 1,250,000 U.S. dollars. The Ministry of Agriculture is also supplying six full-time staff for project planning, management, and evaluation.

At a press conference following the Hilton reception, Dr. Mendoso was asked about an allocation of 900,000 beevels for project evaluation. The Minister replied that the amount was not excessive. He pointed out that in Terra Rica's Rural School Expansion Program evaluators had found several ways to save money which more than compensated for evaluation costs. Dr. Mendoso also explained that project evaluations, over the life of a project, frequently total ten percent of project costs.

The nonformal education project for farmers will begin next month when planting takes place on lowland farms in Terra Rica.

DISCUSSION QUESTIONS

MINISTRY OF AGRICULTURE, REPUBLIC OF TERRA RICA

1. At what points in the life of a project is information about costs and benefits most useful?
2. What is "baseline information" and why is it vital?
3. What criteria were chosen for assessing the nonformal education project in Terra Rica, i.e., what kinds of outcomes were of most interest?
4. Name some possible indicators of progress in relation to the expected outcomes in Terra Rica.
5. Why is it important to make some decisions about final evaluation (impact evaluation) at the very beginning of a project?
6. Do you think "credibility" and "validity" are both important considerations in selecting analysts or evaluators for a project? Why?
7. Should analysts and evaluators be selected from inside or outside the organization managing the project? Why?
8. What are the arguments for and against the evaluator reporting to the project manager?
9. What is a reasonable amount of project budget to spend on analysis for planning and evaluation?

SECTION C

CONCEPTS IN THE ECONOMIC ANALYSIS OF NONFORMAL EDUCATION

A. INTRODUCTION

We said earlier, and we say again, economic analysis of nonformal education is a way of thinking about projects to improve their selection, design, and management.

Section C provides some detail on the concepts, and the vocabulary, which underlie analysis of costs and outcomes in nonformal education. Readers with a good background in the economics of education may go directly to the ten procedural steps in Section D.

This section deals with several basic concepts: education as investment; the idea of economic costs; the monetary value of educational outcomes; use of resources and return on investment over a period of time; individual and governmental perspectives on educational investment.

To illustrate these concepts some simplified examples are given. Once the basic principles of economic analysis are understood the reader can move to Section D where the principles are applied in the more complicated world which usually surrounds nonformal education.

B. EDUCATION AS INVESTMENT

Educators do not usually think of themselves as investors -- that is the work of bankers, financiers, and people with money to spare. But educators who commit teachers and students and materials to projects are, in fact, investing. It is only natural to want good results, a good return on investment.

In recent years investment in education has received considerable attention from prominent economists. This literature has been summarized in a State-of-the-Arts paper by Lockheed, Young, Emery, and Summerskill of the Educational Testing Service (1977).

Starting with the publication of The Economic Value of Education by T. W. Schultz (1963) and Human Capital by G. W. Becker (1964), the effect of schooling on future earnings and wellbeing has been widely accepted in economic thinking. In this view, individuals decide whether to undertake additional schooling -- and how much -- by weighing the costs of attending school (primarily the income which is foregone by going to school rather than by working) against increased earnings in future years as a result of the additional years of schooling. Education is thus viewed as "human capital." An extensive literature has grown from the original studies in which education is considered not only to increase earnings but also social skills and the ability to communicate. Mincer (1970) and Blaug (1976) provide good reviews of these studies.

The "macro" effects, or economy-wide effects, of education have also been studied by economists who seek to determine the contribution of the educational level of a country's population to its economic growth. This line of research, pioneered by E. Dennison in 1962, notes that economic growth cannot be explained by growth in the country's capital and labor alone. So it is hypothesized that the increased education level of the work force is also a factor in explaining economic growth. By providing expanded educational opportunities, a nation gains more productive workers. A number of studies concerning the economic growth patterns of different countries have followed Dennison's original efforts -- sometimes with widely different conclusions (for example, Z. Griliches and D. Jorgensen, 1966).

C. NONFORMAL EDUCATION AS INVESTMENT

The focus of the rather extensive literature on investment in education has been almost exclusively on formal education or the school years. On-the-job training has received some attention -- especially by Mincer, 1962 -- but, in general, little attention has been given to nonformal education. Further, much of the analysis pertains to the industrialized rather than the developing countries. The State-of-the-Arts review, mentioned before, observed (p.7):

> ...it appears the analysis of nonformal education in less developed countries has not received any attention from economists until F. H. Harbison published *A Human Resource Approach to the Development of African Nations* (1971) and "Human Resources and Non-Formal Education" in *New Strategies for Educational Development* edited by C. S. Brembeck and T. Thompson. (1973)

The limited economic study of nonformal education does not mean that the "investment" framework for project evaluation is inappropriate. The problem is to apply these techniques in such a way that they take into account the special features of nonformal education.

Example 1

There is a project to improve the poor nutritional status of children and nonformal education is an important part of the project. Mothers should be encouraged to introduce new foods into infant diets and there is a vigorous campaign to control the water pollution which, through disease, is responsible for much of the nutritional deficiency. The project involves community leaders, mothers, infants, men to dig wells and latrines, health educators, nutrition consultants, agricultural extension agents, men and vehicles from the central motor pool -- a host of different interests and resources.

Now...looking at that project from an investment point of view, what is invested and what benefits result will appear different to the different parties involved. The individual mother, for instance, decides whether to participate based on her notion of the costs to her (e.g. costs of new foods, time lost in the fields, etc.,) against the benefits she is likely to receive (e.g. improved health of children, less disruption of her work in the future, etc.,). Meanwhile, local leaders may be thinking of costs in terms of the needed road projects which they will have to postpone, and they may be thinking of benefits in terms of recognition and remuneration from the central government. Finally, ministry officials may look at the project from yet another investment viewpoint, in terms of an allocation of scarce national resources to one of several urgently needed health projects across the country, and benefits to the largest number of people at a low per person cost.

It is quite possible, then, for the same project to be judged a good investment by the mothers who participated, for example, and a poor investment by the Ministry of Health. It depends upon who defines the objectives of the project and whose objectives are at stake. This manual says repeatedly: it is important that decision-makers and analysts be specific about whose perspectives are involved and what questions are to be addressed in the evaluation. For example:

Example 2

A planner in the Ministry of Education is considering an NFE project to teach new agricultural practices to young farmers. The project will depend upon funding for capital equipment from external donors. Consequently, the Ministry planner must be aware of the interests and priorities of that donor agency, and he must have some idea of whether they will be willing to support the project as conceived. At the same time, no project will succeed unless it is perceived as being a good investment by the intended participants. Even though ministry and donor officials have a project which they think will be a good investment, they must consider the incentives required for successful participation of staff, trainees, and others.

D. CONCEPTS IN ECONOMIC ANALYSIS OF NONFORMAL EDUCATION

As we have seen, the evaluation of NFE projects involves the differing interests and perspectives of participants, community, staff, planners, decision-makers, sponsors. But the economic analysis of NFE projects involves something different and something more. The economic analyst has to step back from the project. The analyst must be ready to assign values to all resources invested in the project and he or she has to identify and assess all relevant outcomes.

1. Economic Costs and Opportunity Costs

In the economy as a whole, the cost of a nonformal education project is the value of all the resources which are used by the project in its planning, implementation, and operation. Some of these inputs come readily to mind: salaries for teachers; outlays for buildings, supplies, equipment, and other items from the project budget. Other inputs are contributed or volunteered and do not show up in a budget. Nonetheless, these factors have value and should be added into project costs. Trainees must devote time to the nonformal education project and, although they are usually not paid for their attendance, they have lost income by participating in the project rather than working on the farm or in other employment. These foregone earnings are called the "opportunity cost" of participating in the project. Similarly, land, special technical skills, other resources donated by government agencies or individuals have an opportunity cost which must be considered. The cost occurs because society loses the opportunity to use these resources by diverting them from other purposes and devoting them to a nonformal education project.

It is most important that all project resource requirements be considered in the evaluation, regardless of their source. When donated resources and contributed time are not included in the assessment, the true cost of the project will be underestimated. As a result, the project may appear more attractive than is really the case.

Identifying the true or economic costs of projects is a skill which improves with practice. Many of us are used to budgets which give project costs. But the economist has to look beyond the project budget to find all the costs which a project generates. He or she finds some additional costs in other budgets (for example, the salaries of staff supplied by other ministries) and he or she finds other costs which have not been budgeted anywhere (for example, the value of crops lost while a farmer is getting training). Getting a good picture of the economic costs of nonformal education requires a way of thinking which is new for many planners and administrators who rely only on project budgets to tell them about costs.

2. Outcomes and Economic Benefits

A nonformal education project involves the transfer of skills, attitudes, or information to participants. This knowledge transfer may in some cases, such as literacy programs, be an end in itself. But the acquisition of skills and knowledge is often viewed as a means to desired economic and social change. The chain of events is this:

(1) nonformal education skills and knowledge are acquired by participants

(2) the participants apply what they have learned in their work and their daily activities.

(3) the new practices bring about changes along economic and social dimensions.

Thus, three general categories of outcomes for nonformal education programs can be identified for evaluation purposes: educational outcomes, skill application outcomes and developmental outcomes which apply to specific areas of economic and social change.

In addition, the investigator should look for the occurrence of unintended outcomes which may have important implications in the project evaluation.

Ideally we would like to be able to measure all types of outcomes for each project. These data would allow us to assess the effectiveness of the program and would contribute to our understanding of the process by which the results were achieved. However project managers and evaluators may find that a comprehensive evaluation effort is beyond the budget and scope of their project. One must then weigh the advantages and limitations of collecting information on each of the project objectives. Educational and skill attainment data, which are most readily obtainable, are not necessarily the best indicators of final project benefits. It is possible for knowledge to be acquired but not put to use, or to be used unprofitably. On the other hand, measures of economic and social change resulting from the project may be costly and difficult to obtain.

So...the project director and evaluator must think it over and decide what outcome measures they can obtain to tell them most about the project -- at a reasonable cost.

Economists talking about project outcomes use the word "benefits" when the outcomes are in monetary terms. Some outcomes of nonformal education can readily be measured with money, e.g., increased production of maize, increased earnings from the sale of folk art, and so on. The economic value of other outcomes is much more difficult to assess, e.g., better nutrition and health, improved self-image, greater political power in the community, and so on. Projects with these objectives are often given priority in nonformal education today. We can usually find ways to quantify the outcomes of projects but the monetary benefits may be difficult to calculate.

As noted in Secton B, outcomes which are not expressed in monetary values can be systematically assessed in light of project costs using a cost/effectiveness framework. When the outcomes have been assigned monetary values they can be compared directly to project costs using cost/benefit analysis.

E. AN INDIVIDUAL INVESTMENT DECISION

To obtain further understanding of economic analysis we will work through an example of a carpenter's helper trying to decide whether he should participate in a nonformal education program. The example has not much to do with real life but it does illustrate investment thinking. We will consider only those cost and benefit items related to money, setting aside other very important factors such as job-satisfaction, convenience, etc. Also, we will not pay any attention to real-life complexities such as inflation, taxes, etc. Once the basic concepts are understood we will get to the refinements, in Section D.

Meanwhile...meet our fictitious friend. "Dollars" in the example stand for any currency.

Example 3

An individual is employed as a carpenter's helper earning 500 dollars per year. A nonformal educational program is offered in which he can become a certified master carpenter and earn 600 dollars a year. The program will take two years to complete with charges of 50 dollars per year for fees and supplies. The program will require giving up the carpenter's helper job and all participants must provide their own tools which cost $40. The individual is 28 years old now and he will probably work until he is 60. From an economic viewpoint, should the individual participate in the program?

1. Determining Costs, Benefits, and the Time Horizon

The individual's decision to participate depends on the answers to two questions:

a. What additional costs will he or she incur by participating?

b. What additional benefits will he or she receive by participating?

In order to make a decision in a systematic way, the individual must list the amount and the timing of all additional costs and benefits. Timing can be specified by choosing a starting date and by listing each event in terms of the number of years past that date. In this case the logical starting point is the point at which the decision will be made. The importance of specifying time will become obvious as we work through this example.

Economists refer to this as "specifying the time horizon," that is, knowing the period of time for which the decision will have economically important effects. In the present example we know the NFE project will involve cost and benefit items from the present (when the individual is 28 years old) until he reaches age 60.

Table 1 provides a simple way of thinking about the concept of time horizon. The first column in the table consists of a series of time symbols, or indicators, running from "t_1" (the year the decision was made to participate in the NFE project) to "t_{32}" (the 32nd year after beginning the project). By thinking of the individual's age now (28) as t_1, and increasing it by one year until the individual ends his working life (60), it is possible to define the number of time periods relevant to the economic evaluation. It is clear from Table 1 that the individual will be interested in cost and benefit items occurring over a 32 year period from t_1 through t_{32}.

This same table can now be expanded to include the information on the occurrence of cost and benefit items over the life of the investment time horizon. Each cost and benefit item will be recorded in current dollars in the appropriate time column. By current dollars we simply mean the value of the cost or benefit item in the year that it occurs. Table 1 can be used to assemble the relevant cost and benefit information in a systematic way.

Referring to the example again, we can fill in Table 1 by considering each of the cost and benefit items one at a time:

Table 1

An Individual Investment Decision With Future Values

(1) Year in Project Time Horizon	(2) Current Value of Costs	(3) Current Value of Benefits	(4) Number of Years Until t_{32}	(5) Future Value of Costs @ 5%	(6) Future Value of Benefits @ 5%
t_1	50 40 500		32	$2811.35	
t_2	50 500		31	$2495.90	
t_3		$ 100	30		$ 432.20
t_4		100	29		411.60
t_5		100	28		392.00
t_6		100	27		373.30
t_7		100	26		355.60
t_8		100	25		338.60
t_9		100	24		322.50
t_{10}		100	23		307.20
t_{11}		100	22		292.50
t_{12}		100	21		278.60
t_{13}		100	20		265.30
t_{14}		100	19		252.70
t_{15}		100	18		240.70
t_{16}		100	17		229.20
t_{17}		100	16		218.30
t_{18}		100	15		207.90
t_{19}		100	14		198.00
t_{20}		100	13		188.60
t_{21}		100	12		179.60
t_{22}		100	11		171.00
t_{23}		100	10		162.90
t_{24}		100	9		155.10
t_{25}		100	8		147.70
t_{26}		100	7		140.70
t_{27}		100	6		134.00
t_{28}		100	5		127.60
t_{29}		100	4		121.60
t_{30}		100	3		115.80
t_{31}		100	2		110.30
t_{32}		100	1		105.00
Totals	$1140	$3000		$5307.25	$7076.10

(1) Tuition and supplies

$50 each at t_1 and t_2

A charge of $50 per year is imposed for fees and supplies each year. On the assumption that the charge is paid by the end of each year, we would indicate a cost in this category of $50 opposite t_1 and at t_2.

(2) Tools

$40 at t_1

Assuming that the individual must buy the required set of tools during the first year of the apprenticeship program, we enter $40 opposite t_1 of Table 1.

(3) "Opportunity Cost" of own time

$500 @ t_1 and $500 @ t_2

When the individual joints the NFE program he will no longer be able to work as a carpenter's apprentice and he will not earn his previous wages of $500 per year. The money which he is giving up is called "foregone income", i.e., the participant will forego this income. It is also called the "opportunity cost" or the "economic cost" of the time which the participant devotes to the program -- instead of doing other productive work.

In this example the opportunity cost of the individual's time is $500 a year for the two years of the NFE program.

(4) Increased Earnings

$100 @ $t_3, t_4, t_5, \ldots\ldots\ldots\ldots, t_{32}$

In the example, if the individual completes the program he will earn a higher salary each year until he stops working. The appropriate benefit measure is the additional income he will receive each year, or the gain due to participation. This is equal to:

(Earnings with the program) - (Earnings without the program) = Gain from the program

In the case of the NFE carpentry program, the gain is:

$600 - $500 = $100

This gain of $100 (in current dollars) will be received each year starting in year t_3 (two years after entering the program) through t_{32} (the year in which the individual plans to stop working).

Notice that this "stream of returns" is indicated by the notation:

$100 @ $t_3, t_4, t_5, \ldots\ldots\ldots\ldots, t_{32}$

The dots are used to represent the years between t_5 and t_{32}. This convention simplifies the recording of information.

2. Summarizing Cost and Benefit Information

The first step in summarizing cost and benefit information is to determine the total costs and total benefits that occur in each year in current dollars. In our example, there are three separate cost items associated with the NFE carpentry program and these can be added together in a "total cost" category as shown in Table 1. Similarly, if there had been several different benefit items associated with the program, one would want to add up "total benefits." Since the program described in Example 1 involves only a single benefit item, no addition is necesary.

A casual inspection of the summary in Table 1 shows that the individual will incur $1140 of costs during the first two years after entering the program. He will also receive a total of $3000 extra income distributed over the balance of his projected working lifetime. Such a pattern in the timing of costs and benefits is typical of educational investments. The costs are said to be front loaded -- that is, occurring at the beginning of the project and the benefits are said to be end loaded -- occurring toward the end.

If the individual were indifferent to the timing of the various costs and benefits, we can see from Table 1 that participation in the training program would unquestionably be a good investment. Individuals and institutions are, however, never indifferent to the timing of costs and benefits. Even though total benefits outweigh total costs in current dollars, participation in the program may or may not be a good idea from an economic standpoint. The carpenter's helper knows that the value of the costs he will incur, and the benefits he will gain, are not constant over time. To decide whether or not participation in the NFE program is justified he must adjust for differences in time.

3. Adjusting for Time

Given the choice between receiving $100 today or $100 one year in the future, individuals will generally prefer receiving the payment now. Similarly, it is preferable to pay out $100 next year rather than today -- other things being equal. This same reasoning applies in the assessment of costs and benefits in NFE projects: immediate costs and benefits are favored by decision-makers while benefits or costs occurring well into the future are given less value.

The economic principle behind this viewpoint is straightforward: The $100 (or other resources) which are available today can be invested to yield more than the original amount in a year's time. The annual return on these funds -- or the rate of interest -- represents the cost of spending the $100 today rather than in a year's time. Conversely, we know that one has to invest less than $100 today in order to have $100 a year from now. Indeed at a 10 percent rate of interest one must invest less than $91.00 to have $100 in a year's time.

Procedures have been developed to adjust to a common base costs and benefits which occur at different points in time. These are explained below. But, first, the principle of compound interest and corresponding future values are discussed. Then the process for discounting the value of future expenditures or benefits to a common point in time is explained.

Compound Interest and Future Value. When funds are invested at a given rate of interest, the future value of this investment at the end of a year's time is equal to the amount of the initial investment plus the investment multiplied by the rate of interest. Mathematically, this relationship between costs and returns is written as follows:

$$FV = PV + (r \times PV)$$
or $$FV = PV\,(1 + r)$$

Where:

FV = Future Value (value of future payment in current dollars)
PV = Present Value (value of present payment forgone)
r = rate of interest

Thus, an investment of \$100 at a ten percent rate of interest will yield \$110 at the end of the first year.

$$\boxed{\$110 = \$100\ (1 + 0.10)}$$

If this money then continues to be reinvested year after year at the same 10 percent rate of interest, its value compounds annually, and over a period of years the amount will grow substantially. Let's return to our algebraic equation again. If we want to know the value of the investment after say two years, we would write the equation as follows:

$$FV_2 = FV_1\ (1 + r),$$

and since $FV_1 = PV\ (1 + r)$,

$$FV_2 = PV\ (1 + r) \times (1 + r), \text{ or}$$

$$FV_2 = PV\ (1 + r)^2$$

Thus, in the second year, our investment of \$100 at a 10 percent rate of interest is worth \$121.

$$\boxed{\begin{aligned} FV_2 &= \$100\ (1.0 + 0.10)^2 \\ &= \$100\ (1.21) \\ &= \$121 \end{aligned}}$$

Similarly, after any number of years, or t years,

$$FV_t = PV\ (1 + r)^t$$

Using this equation, we see that after only 8 years, the \$100 investment at 10 percent has more than doubled.

$$\boxed{\begin{aligned} FV_8 &= \$100\ (1.0 + 0.10)^8 \\ &= \$100\ (2.14) \\ &= \$214 \end{aligned}}$$

As one computes the future value of money the calculations become increasingly cumbersome. So we also have tables to help and Table 2 shows the Future Value (FV) of one unit of currency after a specified period of time (t) at a specified rate of interest (r).

To find the value of \$1 after 15 years at r = .08, you would read across the top row of the table to r = .08 and then read down that column to the row that matches t = 15. As seen from the table, one dollar would be worth 3.172 dollars after 15 years at r = .08. One hundred dollars would be worth 100 times 3.172 or 317.20 dollars.

Notice as "t" or "r" increases, the future value of an initial dollar investment goes up. For example, \$1 compounded at r = .08 will be worth \$2.518 after 12 years. If r were 15, the same dollar would be worth \$5.350. Similarly, if the dollar were held for 20 years at r = .15, it would be worth \$16.367.

Applying these principles of compounded interest to costs and benefits which occur at different points in time allows us to compare their value at a common point in time.

Now back to the poor carpenter's helper who doesn't know whether to keep his job or quit and become a master carpenter. Table 1 gives an

Table 2

Future Value (FV) of $1 Compounded Annually For t Years

t	r=.03	.05	.08	.10	.12	.15
1	1.030	1.050	1.080	1.100	1.120	1.150
2	1.061	1.103	1.166	1.210	1.254	1.323
3	1.093	1.158	1.260	1.331	1.405	1.521
4	1.126	1.216	1.360	1.464	1.574	1.749
5	1.159	1.276	1.469	1.611	1.762	2.011
6	1.194	1.340	1.587	1.772	1.974	2.313
7	1.230	1.407	1.714	1.949	2.211	2.660
8	1.267	1.477	1.851	2.144	2.476	3.059
9	1.305	1.551	1.999	2.358	2.773	3.518
10	1.344	1.629	2.159	2.594	3.106	4.046
11	1.348	1.710	2.332	2.853	3.479	4.652
12	1.426	1.769	2.518	3.138	3.896	5.350
13	1.469	1.886	2.720	3.452	4.363	6.153
14	1.153	1.980	2.937	3.797	4.887	7.076
15	1.558	2.079	3.172	4.177	5.474	8.137
16	1.605	2.183	3.426	4.595	6.130	9.358
17	1.653	2.292	3.700	5.054	6.866	10.761
18	1.702	2.407	3.996	5.560	7.690	12.375
19	1.754	2.527	4.316	6.116	8.613	14.232
20	1.806	2.653	4.661	6.727	9.646	16.367
21	1.860	2.786	5.034	7.400	10.804	18.822
22	1.916	2.925	5.437	8.140	12.100	21.645
23	1.974	3.072	5.871	8.954	13.552	24.891
24	2.033	3.225	6.341	9.850	15.179	28.625
25	2.094	3.386	6.848	10.835	17.000	32.919
26	2.517	3.556	7.396	11.918	19.040	37.857
27	2.221	3.733	7.988	13.110	21.325	43.535
28	2.288	3.920	8.627	14.421	23.844	50.066
29	2.537	4.116	9.317	15.863	26.750	57.575
30	2.427	4.322	10.063	17.449	29.960	66.212
31	2.500	4.538	10.868	19.194	33.555	76.144
32	2.575	4.765	11.737	21.114	37.582	87.565
33	2.652	5.003	12.676	23.225	42.092	100.700
34	2.732	5.253	13.690	25.548	47.142	115.805
35	2.814	5.516	14.785	28.102	52.800	133.175
40	3.262	7.040	21.725	45.259	93.051	378.721
60	5.892	18.679	101.257	304.482	897.596	7370.195
80	10.641	49.561	471.954	2048.400	8658.472	XXXXXXXX

economic analysis of his situation. Column 2 shows the costs to him in the next two years. Column 3 shows the benefits in increase wages which he will gain over the next 30 years.

But these are presented as current values and, as explained above, $1 today is not equivalent to $1 thirty years from now. So Column 5 shows what the costs of the NFE training amount to if the individual, instead of taking the training, invested the same money in land, for example, which increases in value 5% each year for 30 years. Finally, Column 6 presents the value of the increased wages which the new master carpenter will receive after training -- on the assumption that he also invests this additional money each year in land which increases 5 percent annually.

We are now ready to give our recommendation to the carpenter's helper (if he has not fled in confusion) because we now know the value of all his costs and benefits at a common point in time. In this case the common point in time is 32 years from now, t_{32} in the table.

In a nutshell, the nonformal education program is a good deal for the carpenter's helper! Adding up Column 5 in Table 1 we find that his costs (fees, tools, foregone income) compounded at 5 percent over 32 years amount to $5307. Adding up Column 6 we discover that his benefits (his increased wages), compounded at 5 percent over 30 years, total $6743. He is ahead nearly $1500.

In the next couple of pages we will show how the same comparisons can be made at other points in time and the advantages of selecting the point t_1 for cost benefit and cost effectiveness analysis.

Discounting and Present Value. We have just seen how the concept of compound interest can be used to compare costs and benefits which occur in different years. With this method we can calculate future values of costs and benefits at some common time point in the future. However, the calculations are cumbersome when the project time horizon is far in the future. Also, the values involved are conceptually remote from decisions to be made in the present.

The same principal can be applied to comparing the value of costs and benefits at time t_1 -- right now -- or at any other specified time in the life of the project. Looking at Table 2 again, we see that it not only shows the future value of $1 in one's possession, it can also be used to determine how much $1 which will be paid in the future is worth now.

Example 4

Table 2 indicates that $1 will double to $2 in nine years when the interest rate is .08. We can use this same information to ask: how much should one be willing to pay now for the promise of a $2 payment nine years from now? The answer: $1 (because $1 will double to $2).

Similarly we could ask: how much should one be willing to pay now for the promise of a $1 payment nine years from now at an interest rate of .08. Answer: $0.50 (because this $0.50 will double to $1 by then).

As the examples show, we can find out from Table 2 how much a future payment of $1 is worth at the present time for other values of "t" (time) and "r" (interest rate). When answering this question, the interest rate is commonly called the discount rate. The present value of the future payment is known as the discounted present value (DPV).

Table 3 provides you with the discounted present value of a $1 payment in the future for various values of "t" and "r". Discounted present value can also be calculated as follows:

We know that the relationship between the initial value of the investment and its future value after t years at an interest rate is given by:

$$FV = PV\ (1 + r)^t.$$

Dividing both sides of the equation by $(1 + r)^t$, we have

$$\frac{FV}{(1 + r)^t} = \frac{PV\ (1 + r)^t}{(1 + r)^t}$$

or

$$PV = \frac{FV}{(1 + r)^t}.$$

In determining the discounted present value of costs and benefits it is important to notice that the later a payment occurs the lower the DPV. For instance, in Table 3, when r= 05, the discounted present value for $100 one year out is $95.24 while the DPV for $100 ten years out is $61.39.

Let's get back to carpentry: what is the total value of all of the costs and all of the benefits associated with the individual's participation in the NFE program -- when these are discounted at 5% back to the year in which the individual enters the program?

We can use Table 3 to find the discounted present value of each cost and benefit for each year. The current and discounted costs and benefits

Table 3

Present Value (PV) of a $1 Payment t Years in the Future Discounted at r

t	r = .03	.05	.08	.10	.12	.15
1	0.9709	0.9524	0.9259	0.9091	0.8929	0.8696
2	0.9426	0.9070	0.8573	0.8264	0.7972	0.7561
3	0.9151	0.8638	0.7938	0.7513	0.7118	0.6575
4	0.8885	0.8227	0.7350	0.6830	0.6355	0.5718
5	0.8626	0.7835	0.6806	0.6209	0.5674	0.4972
6	0.8675	0.7462	0.6302	0.5645	0.5066	0.4323
7	0.8131	0.7107	0.5835	0.5132	0.4523	0.3759
8	0.7894	0.6768	0.5403	0.4665	0.4039	0.3269
9	0.7664	0.6446	0.5002	0.4241	0.3606	0.2843
10	0.7441	0.6139	0.4632	0.3855	0.3220	0.2472
11	0.7224	0.5847	0.4289	0.3505	0.2875	0.2149
12	0.7014	0.5668	0.4289	0.3505	0.2875	0.2149
13	0.6810	0.5305	0.3677	0.2897	0.2292	0.1625
14	0.6611	0.5051	0.3405	0.2633	0.2046	0.1413
15	0.6419	0.4810	0.3152	0.2394	0.1827	0.1229
16	0.6232	0.4581	0.2919	0.2176	0.1631	0.1069
17	0.6050	0.4363	0.2703	0.1978	0.1456	0.0929
18	0.5874	0.4155	0.2502	0.1799	0.1300	0.0808
19	0.5703	0.3957	0.2317	0.1635	0.1161	0.0703
20	0.5537	0.3769	0.2145	0.1486	0.1037	0.0611
21	0.5675	0.3589	0.1987	0.1351	0.0926	0.0531
22	0.5219	0.3418	0.1839	0.1228	0.0826	0.0462
23	0.5067	0.3256	0.1703	0.1117	0.0738	0.0402
24	0.4919	0.3101	0.1577	0.1015	0.0659	0.0349
25	0.4776	0.2953	0.1460	0.0923	0.0588	0.0304
26	0.4637	0.2812	0.1352	0.0839	0.0525	0.0264
27	0.4502	0.2678	0.1252	0.0763	0.0469	0.0230
28	0.4371	0.2551	0.1159	0.0693	0.0419	0.0200
29	0.4243	0.2429	0.1073	0.0630	0.0374	0.0174
30	0.4120	0.2314	0.0994	0.0573	0.0334	0.0151
31	0.4000	0.2204	0.0920	0.0521	0.0298	0.0131
32	0.3883	0.2099	0.0852	0.0474	0.0266	0.0114
33	0.3770	0.1999	0.0789	0.0431	0.0238	0.0099
34	0.3660	0.1904	0.0730	0.0391	0.0212	0.0086
35	0.3554	0.1813	0.0676	0.0356	0.0189	0.0075
40	0.3066	0.1420	0.0460	0.0221	0.0107	0.0037
60	0.1697	0.0535	0.0099	0.0033	0.0011	0.0002
80	0.0940	0.0202	0.0021	0.0005	0.0001	0.0000

are entered in Table 4. Columns 4 and 5 of Table 4 show these values discounted back to the beginning of the project at t_1, using a discount rate of r=.05. On the bottom line we see that costs and benefits compared at the same point in time are $1060 and $1394 respectively. Once again an economic analysis paints a favorable picture of this nonformal education program.

Discounted Present Value of a Uniform Stream of Payments. It can be a lot of work calculating the DPV of cost and benefit items from tables when a separate determination has to be made for each year involved. In computing these figures for the carpenter's helper, for example, we had to use Table 3 more than thirty times!

Moreover, it often hapens in educational investments that there is a uniform "stream of payments" over a span of many years. We are talking here about projects in which the current monetary value of payments is the same from year to year.

To make the analyst's life easier, tables have been developed which give the value of a stream of uniform payments (see Table 5). In such a table the DPV of a stream of $1 payments every year for t years is discounted at various rates of interest.

We can illustrate use of Table 5 with the carpentry example: Discounted Present Value of Costs remain as shown before (Table 4). Discounted Present Value of the Stream of Benefits is calculated by subtracting the value of $1 at t_2 from the value of $1 at t_{32} as shown in Table 5. Thus, 15.80 - 1.86 = 13.94 x $100 = $1394. This short cut gives us the same present value of the benefits as we found before, using Table 3 so laboriously, with a discount rate of 5 percent both times.

Table 4

An Individual Investment Decision With Discounted Present Values

(1) Year in Project Time Horizon	(2) Current Value of Costs	(3) Current Value of Benefits	(4) Discounted Value of Costs @ 5%	(5) Discounted Value of Benefits @ 5%
t_1	50 40 500		$561.68	
t_2	50 500		$498.85	
t_3		$100		$86.38
t_4		100		82.27
t_5		100		78.35
t_6		100		74.62
t_7		100		71.07
t_8		100		67.68
t_9		100		64.46
t_{10}		100		61.39
t_{11}		100		58.47
t_{12}		100		55.68
t_{13}		100		53.05
t_{14}		100		50.51
t_{15}		100		48.10
t_{16}		100		45.81
t_{17}		100		43.63
t_{18}		100		41.55
t_{19}		100		39.57
t_{20}		100		37.69
t_{21}		100		35.89
t_{22}		100		34.18
t_{23}		100		32.56
t_{24}		100		31.01
t_{25}		100		29.53
t_{26}		100		28.12
t_{27}		100		26.78
t_{28}		100		25.51
t_{29}		100		24.29
t_{30}		100		23.14
t_{31}		100		22.04
t_{32}		100		20.99
Totals	$1,140	$3,000	$1,060.53	$1,394.32

Table 5

Present Value of $1 Received Annually for t Years

t	r = .03	.05	.08	.10	.12	.15
1	.97	.95	.93	.91	.89	.87
2	1.91	1.86	1.78	1.74	1.69	1.63
3	2.83	2.72	2.58	2.49	2.40	2.28
4	3.72	3.55	3.31	3.17	3.04	2.85
5	4.58	4.33	3.99	3.79	3.60	3.35
6	5.42	5.08	4.62	4.36	4.11	3.78
7	6.23	5.79	5.21	4.87	4.56	4.16
8	7.02	6.46	5.75	5.33	4.97	4.49
9	7.79	7.11	6.25	5.76	5.33	4.77
10	8.53	7.72	6.71	6.14	5.65	5.02
11	9.25	8.31	7.14	6.50	5.94	5.23
12	9.95	8.86	7.54	6.81	6.19	5.42
13	10.63	9.39	7.90	7.10	6.42	5.58
14	11.30	9.90	8.24	7.37	6.63	5.72
15	11.94	10.38	8.56	7.61	6.81	5.85
16	12.56	10.84	8.85	7.82	6.97	5.95
17	13.17	11.27	9.12	8.02	7.12	6.05
18	13.75	11.69	9.37	8.20	7.25	6.13
19	14.32	12.09	9.60	8.36	7.37	6.20
20	14.88	12.46	9.82	8.51	7.47	6.26
21	15.42	12.82	10.02	8.66	7.56	6.31
22	15.94	13.16	10.20	8.77	7.64	6.36
23	16.44	13.49	10.37	8.88	7.72	6.40
24	16.94	13.80	10.53	8.98	7.78	6.43
25	17.41	14.09	10.67	9.08	7.84	6.46
26	17.88	14.38	10.81	9.16	7.90	6.49
27	18.33	14.64	10.94	9.24	7.94	6.51
28	18.76	14.90	11.05	9.31	7.98	6.53
29	19.19	15.14	11.16	9.37	8.02	6.55
30	19.60	15.37	11.26	9.43	8.06	6.57
31	20.00	15.59	11.35	9.48	8.08	6.58
32	20.39	15.80	11.44	9.53	8.11	6.59
33	20.77	16.00	11.51	9.57	8.14	6.60
34	21.13	16.19	11.59	9.61	8.16	6.61
35	21.49	16.37	11.65	9.64	8.18	6.62
40	23.11	17.16	11.92	9.78	8.24	6.64
60	27.68	18.93	12.38	9.97	8.32	6.67
80	30.20	19.60	12.47	10.00	8.33	6.67
99	31.55	19.84	12.49	10.00	8.33	6.67
∞	33.33	20.00	12.50	10.00	8.33	6.67

F. A GOVERNMENTAL INVESTMENT DECISION

We have now looked at the idea of education as investment and we have applied this model to an individual's decision about participating in nonformal education for carpentry.

The same reasoning and procedures can be used at various levels of government to evaluate investments in NFE projects. As we work through the example below you will see that the record-keeping and the computations are essentially unchanged. We must now concentrate on the question of how costs and benefits are to be viewed from the broader perspective of society as a whole.

1. Social Perspective

Let us stay with nonformal education for carpentry. In this case a central government is assessing the merits of establishing an NFE program in a rural village - as follows:

Example 5

The central government would provide training materials and a master carpenter to a village for two years to train five local carpenters' apprentices. The village would provide a suitable building to serve as a meeting place, heat during the winter months, and would have to pay $150 per year toward the teacher's salary. The village could pass on part of the cost to the participants by charging up to $50 per year to each. The village could also require participants to provide their own tools.

The village leaders calculate that a suitable building will cost $100 per year to rent and $50 per year to heat. They survey the village and find five carpenters' apprentices who are qualified and willing to attend the program. By chance, the apprentices all happen to be 28 years of age!

The main difference between this example and the case of the individual discussed previously lies in the perspective of the decision-maker. The central government must assess the advantages of investing in the program from the perspective of society as a whole. The basic questions concerning the investment are the same as those asked by the individual - but from the perspective of society:

(1) What additional costs does society incur from the project?

(2) What additional benefits will society receive from the project?

In an evaluation of this project government analysts begin by listing the amount and timing of all additional costs and benefits which can be associated with the program. The concepts of social cost and social benefit are more complex than those for the individual. Social cost is the value of all resources used by the project regardless of the sources from which funds and contributions come. Similarily, social benefits are the value of all the effects of the project.

2. Determining a Time Horizon

The first question for governmental analysts is the period of time over which they expect their decision to affect the economy. In the case of the individual we found his entire working life to be the appropriate time horizon. In the present example of village training for carpentry we will make things easy by using the same time horizon, 32 years, for all five particpants.

It should be noted, however, that the effects of this village program in nonformal education may well extend beyond the working lives of the individual participants. For example, with increased incomes the families of the new carpenters may have more children at school for longer periods of time, with even more income resulting in the future. But the amount of these benefits to the next generation is difficult to know, and they will be discounted heavily because the time horizon is so many years ahead. Consequently, we note these benefits in our analysis of the village carpentry program but we have not assigned them values in our calculations.

Table 6 shows the various cost and benefit items in the nonformal education program for village carpentry. Explanation for each item follows:

3. Cost and Benefit Analysis

(1) Teacher's Salary

$650 @ t_1 and t_2

A teacher is hired at $650 per year to give the five carpenters' helpers the skills required for master carpenters' work. Although $150 of the teacher's salary is in the village project budget, and $500 of the teacher's salary is paid by the central government, the total salary of $650 is the appropriate cost figure for the analysis. This figure reflects the value of the teacher's labor. Because the master carpenter is employed as a teacher the economy has lost the goods and services he would otherwise produce and those are valued at $650 per year.

(2) Tools

$200 @ t_1

Five sets of tools are required for program participants at the beginning of the program, at $40 per set.

(3) Building Rental and Heat

$150 @ t_1 and t_2

A suitable building has been found for the village project costing $150 a year for rent and heat. The fact that the village council, rather than the central government, is paying this cost makes no difference. All costs, regardless of source, must be included in Table 6.

Table 6

A Governmental Investment Decision With Discounted Present Values

(1) Year in Project Time Horizon	(2) Current Value of Costs	(3) Current Value of Benefits	(4) Discounted Value of Costs @ 5%	(5) Discounted Value of Benefits @ 5%
t_1	$650 200 150 2,500		$3,332	
t_2	650 150 2,500		2,993	
t_3		$ 500		$431.90
t_4		500		411.35
t_5		500		391.75
t_6		500		373.10
t_7		500		355.35
t_8		500		338.40
t_9		500		322.30
t_{10}		500		306.95
t_{11}		500		292.35
t_{12}		500		278.40
t_{13}		500		265.25
t_{14}		500		252.55
t_{15}		500		240.50
t_{16}		500		229.05
t_{17}		500		218.15
t_{18}		500		207.75
t_{19}		500		197.85
t_{20}		500		188.45
t_{21}		500		179.45
t_{22}		500		170.90
t_{23}		500		162.80
t_{24}		500		155.05
t_{25}		500		147.65
t_{26}		500		140.60
t_{27}		500		133.90
t_{28}		500		127.55
t_{29}		500		121.45
t_{30}		500		115.70
t_{31}		500		110.20
t_{32}		500		104.95
Totals	$6,800	$15,000	$6,325	$6,971.60

We should point out that even if the village owned the building, and did not have to pay rent, there may still be an economic cost if other activities are displaced from the building as a result of the NFE program. In this case, the cost that should be listed in Table 6 would be the value of the building to the activity that is displaced, for instance, the rent they have to pay in a comparable place.

Another complication which sometimes arises in economic analysis of nonformal education has to do with shared facilities. For example, the village carpentry program might use a governmental school after school hours. If the NFE program creates additional costs by using the school or displaces other after-school programs, some reasonable share of facility costs should be entered in Table 6. The idea is to capture all costs of the program, whether they appear in the program budget or not.

(4) Opportunity Costs of Participants' Time

$2500 at t_1 and t_2

As in the case of the individual carpenter's helper, we are assuming that the five participants in the village program are giving up their jobs as carpenters' apprentices and, consequently, are giving up their earnings of $500 per year each.

This can also be viewed as a cost to society because, if the five individuals did not enroll in the NFE program, they would have spent the two years doing carpentry for various villagers and village projects. The apprentices would have received payment for their labor, and the village would have received the products of their labor. When the apprentices go into nonformal education full-time, the village loses their production. The value of this lost production is the cost to the economy of the time the participants spend in training.

Economic theory suggests that in a competitive labor market which operates freely, wages indicate the value of a worker's contribution to production. So, for instance, the value of the five apprentices' lost production would amount to $2500 per year. But in some situations an analyst would have reason to think that wages are not a good measure of lost or foregone production. Indeed, in some situations there may be no wage scales readily available to gauge how much production is lost when participants enter nonformal education.

In these circumstances economic analysts come up with a shadow price, to take the place of a wage figure, in order to indicate the approximate value of production which is lost. By shadow price we mean an estimate of someone's productive contribution to society when that cannot be judged from wages. As we shall see in Section D this procedure should be used cautiously and reasons for using shadow prices rather than wages should be documented.

(5) Increased Earnings

\$500 @ t_3, t_4, t_5............t_{32}

The total benefit to the economy from the village carpentry program is the value of the additional productivity of the participants as a result of the program. The projected increased earnings are used as an indicator of this additional production. In this example we estimate that the newly trained carpenters will each earn $100 more annually, i.e., the group will earn $500 more annually, for 30 years following the NFE project.

Again if there are clear reasons to suspect that this increase in earnings is a poor measure of the gain in carpentry production, the analyst could construct a shadow price to reflect best estimates of actual production gains.

4. Summarizing

As we saw earlier when examining the investment decision by an individual, cost and benefit information needs to be summarized. Table 6 first states all costs and benefits in current dollars. Then Table 6 gives the same information at a common point in time, that is, the discounted present value of each item using a 5 per cent discount rate.

From Table 6 we learn that the discounted present value of benefits in the village program is greater than the discounted present value of costs. This nonformal education project is a good social investment - from a longterm economic standpoint.

* * * * * * * * * * * * *

With this introduction to concepts and vocabulary behind us, we move to Section D and the following ten procedural steps in the economic analysis of nonformal education:

Procedural Steps in the Economic Analysis of Nonformal Education

Step 1. Define the Project and Specify the Aim of the Investigation

Step 2. List Project Resources

Step 3. Determine and Adjust Resource Costs

Step 4. Summarize and Analyze Project Costs

Step 5. Specify Intended Project Outcomes: Educational

Step 6. Specify Intended Project Outcomes: Skill Application

Step 7. Specify Development Outcomes: Intended and Unintended

Step 8. Value and Adjust Project Outcomes

Step 9. Relate Project Costs and Outcomes

Step 10. Interpret the Results of the Analysis

STEP 1

DEFINE THE PROJECT AND SPECIFY THE AIM OF THE INVESTIGATION

The SCOPE approach is organized around a collection of ideas and a sequence of procedural steps. These lead the analyst from a narrow focus on the project to a broader view of the relationship between project costs and outcomes and the socioeconomic environment in which they occur. The steps should be viewed as a checklist of fundamental assessment tasks which build upon one another and which must be repeated and refined several times during the course of the investigation. It is not necessary to follow the steps rigidly in the order presented. Throughout the discussion, worksheets are provided which allow the analyst to keep complete records of important information about project analysis. Such records are useful for review during the assessment process and for writing reports later.

Before project assessment begins, the first broad step for implementing the SCOPE approach is for the analyst to carefully define the project under consideration and identify the precise aim and range of the investigation. We have said earlier that project analysis can make possible a better allocation of resources between and within projects. However, the analytical process of costing project resources, and relating resources to project outcomes, depends on a clear specification of project objectives, operation, context, and questions the evaluation is to answer. For, it is only when the nature of the project and the precise purpose of the investigation are understood that the analyst can provide the data required for decisions to be made.

The preliminary work of defining the project and specifying the aim of the investigation is not as simple as one might assume. NFE planning in many countries is characterized by guesswork and improvisation. Projects and programs are often designed on the basis of an intuitive sense of learning needs, ambiguous project goals, lofty notions about what NFE can accomplish, and loosely defined alternatives for the use of project resources. Thus, it often becomes the role of the analyst to clarify the project objectives and alternatives, to resolve contradictions and discrepancies, and to identify the questions to be answered before beginning a project assessment.

Procedures for defining the project and identifying the aim of the investigation are as follows:

A. Identify what the project is intended to accomplish.
B. Specify project design and organization.
C. Review underlying assumptions and project context.
D. Define alternatives for decision-making.
E. Establish a timeline for reporting the investigation.

The time to be spent on each substep depends upon the nature of the questions asked and the work schedule established for the investigation.

A. IDENTIFY WHAT THE PROJECT IS INTENDED TO ACCOMPLISH

The first task of the analyst is to define with reasonable clarity the goals and objectives of the project. Goals and objectives are different kinds of statements about expected project outcomes.

GOALS are usually described in terms of broad, long-range results.

OBJECTIVES are specific, short-range outcomes expected to contribute to the achievement of the ultimate goals. Objectives are stated in operational terms which allow for some degree of measurement.

Adequate assessment of a project is based upon what the project is intended to achieve. Therefore goals and objectives should be reviewed and made explicit in order to identify and measure problems and progress.

1. Difficulty in Identifying Goals and Objectives

Sometimes, in educational projects, and in experimental NFE projects in particular, goals and objectives become confused and difficult to identify. For example, it is not uncommon for project aims to be expressed only in vague statements such as "improvement in the quality of life" or "increased participation of the rural poor," without identification of what is to be accomplished in order to reach these ends. In contrast, aims are sometimes stated only in the most narrow terms, such as "increase the purchase and use of nitrate fertilizers," "learn to operate a sewing machine at a Craftsman II level of performance," or "increase farmers' exposure to agricultural demonstrations and field day programs." In this case, analysis must look beyond these surface objectives to reveal how these intended behaviors are expected to contribute to broader development goals.

NFE projects designed to produce a wide variety of expected outcomes make the problem of correctly identifying project aims more complicated. Important objectives may be lost in a long list of purposes or may become confused by mutually conflicting aims (as when the project is established to produce skills marketable in urban areas, while at the same time decreasing the rate of urban labor migration). Also, goals may become modified or completely altered as the project develops, leaving a gap between new aims and the prior means of implementation.

> An interesting example of this situation was a rural development program conducted in an administrative division in Kenya in 1970. Originally, this multi-purpose program was designed to produce, among other results, a substantial increase in the rate of maize production to enable the division to become self-sufficient in this primary staple. In order to achieve this goal, the program placed emphasis on relatively large farmers where increased yields would make a notable difference in overall divisional production. In 1973, however, the foreign donor for the program became very much concerned with questions of equal distribution of income within the division and with crop yields among the poorest farmers. Evaluation of that program in 1973, which attempted to assess progress toward the abruptly changed aims, failed to recognize sufficiently the natural lag in the implementation design. Thus, the donor became unduly discouraged as to the program's potential impact.

In such a situation, the analyst is faced not only with the difficult task of correctly identifying the original goals and objectives, but with making the evaluation flexible enough to assess progress toward "moving targets." The hazard of incorrectly identifying and ordering project aims can be minimized, however, if assumptions are made clear from the beginning and if analysis is conducted openly and subjected to critical review. We shall return to this point later.

2. A Simple Classification Scheme

A simple classification scheme which allows for the initial identification of NFE project goals and objectives is shown in Table 1.1 and in Figure 1.1, and includes the following three categories: Learning Objectives, Skill Application Objectives, and Overall Development Goals. Each category represents a segment in a chain of events that links the training inputs to the ultimate goal of national growth and development.

a. Learning Objectives

These are immediate education or training outcomes which result from the appropriate management of project resources and techniques.

Figure 1.1 Chain of Events Linking NFE Project to Wider Development Goals

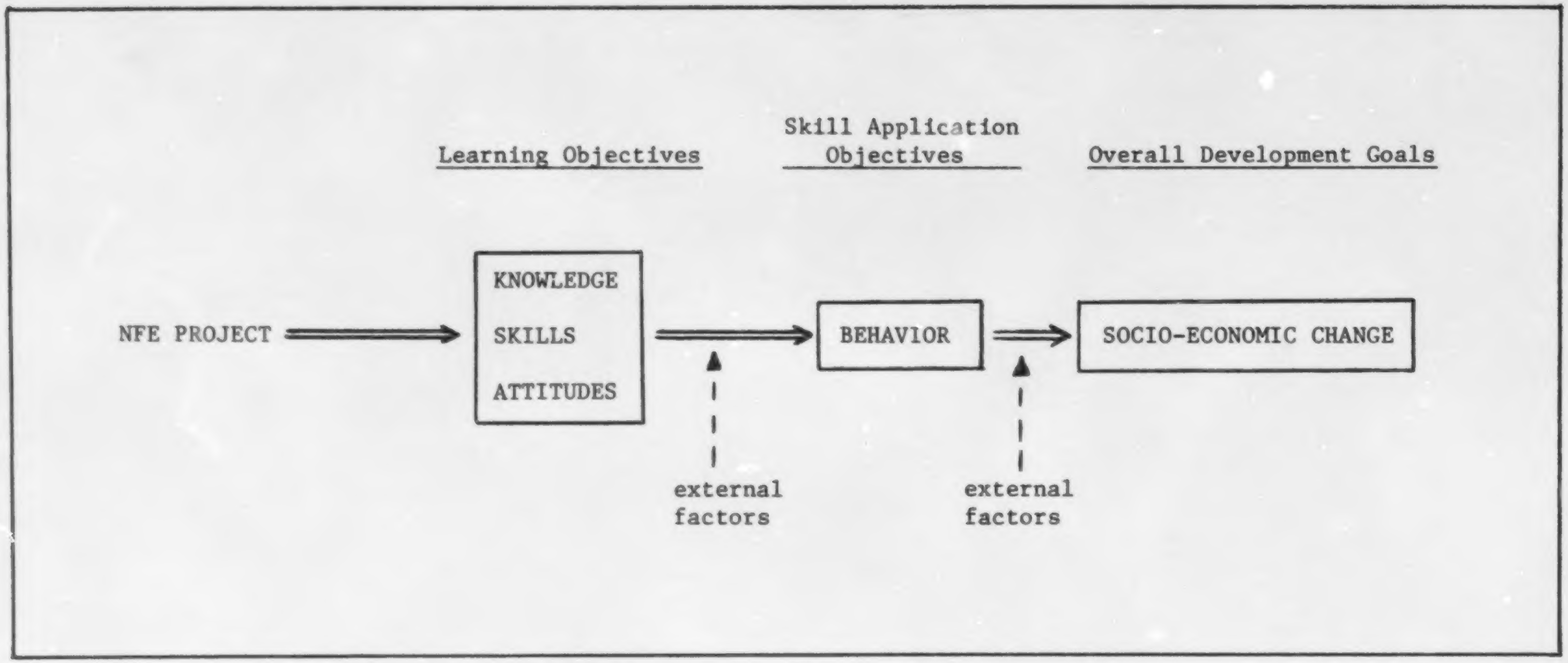

Learning Objectives
Skill Application Objectives
Overall Development Goals
NFE PROJECT
KNOWLEDGE
SKILLS
ATTITUDES
BEHAVIOR
SOCIO-ECONOMIC CHANGE
external factors
external factors

Table 1.1

PROJECT OBJECTIVES AND OVERALL DEVELOPMENT GOALS

Project Name: Kitulu Kazi
Project Type: Rural Youth Employment
Sponsor: Kitulu Local Council
Perspective: Dept. of Local Government

PROJECT OBJECTIVE	TARGET GROUP/ AREA
Learning Objective	
LO 1. Each participant in the project will learn simple reading, writing, and arithmetic skills so as to pass a project-designed essay and objective exam after 8 months of training.	post primary school youth in Kitulu Village who are not attending secondary school
LO 2. Each participant receiving training in building or carpentry skills will perform at the C-I level on the National Vocational Training Test after 12 months of special instruction.	
LO 3. Each participant will learn management and business skills, including the ability to keep accounts, repair tools, fix rates, fill forms, and organize work schedules so as to pass an oral project exam at the end of 12 months of training.	
Skill Application Objective	
SO 1. Each participant will obtain wage employment at a wage rate above the minimum rural standard of living, or will engage in a viable self-employment crafts activity within 6 months of completing the training program.	project participants
SO 2. Each participant will be able to sustain wage employment or viable self-employment in a crafts activity for at least 2 years after employment is initiated.	project participants
OVERALL DEVELOPMENT GOAL	
G 1. The project will help build a skilled labor force which can respond to local employment needs.	Kitulu Village/ Eastern District
G 2. The project will encourage agricultural production by making available local craftsmen who can provide satisfactory farm related goods and services.	
G 3. The project will increase learning opportunities and skill training, while helping to stabilize the expansion of formal secondary education.	

Such outcomes may include increased critical skills, attitudinal changes, improved self-awareness, cognitive development, and knowledge acquisition. Since any educational project assessment is based upon specification of educational objectives, such objectives should be stated in operational terms. Objectives should indicate who is supposed to learn what under which conditions and by what date. Examples of learning objectives for a rural youth training project are presented in Table 1.1.

b. Skill Application Objectives

We hope that if learning objectives are achieved, they will be followed by the transfer and application of what is learned. For example, in a literacy project established for adult farmers, finding out if the participants can read may not be as important as discovering if they are reading, and if they are reading agricultural materials. In a similar fashion, the immediate learning objective of training rural youth in carpentry skills may be significant only if it leads to employment and increased income. The development of learning outcomes does not guarantee the achievement of skill application objectives. Skill transfer and application are longer-term objectives whose attainment may be affected by factors outside the educational sector. Examples of skill application objectives are presented in Table 1.1.

c. Overall Development Goals

The third segment in the chain of development events is the long-range improvements in the social and economic area with which the project is concerned. The improvements should be closely linked with national development strategies for NFE and with national policies concerning the relationship between education and other development sectors (i.e., agriculture, health, community development). They also may relate to the manner in which such policies are to be implemented (i.e., self-help and popular participation, decentralized planning and management). Again, we assume that if skill application objectives are realized, they will contribute to the achievement of these wider social and economic changes.

Overall development goals, however, should not be stated too broadly. When expressed in such vague terms as "increase the standard of living," "improve political stability" or "further rural development," they may be of little value for project assessment. In order to clarify the contribution of the project's more immediate outcomes to these broader changes, it is necessary to state specific social or economic changes which we expect to occur. Examples of such goals are presented in Table 1.1.

3. Methods for Specifying Goals and Objectives

We have been considering project goals and objectives solely from the perspective of government or private agencies responsible for developing the activity. These project aims should not be confused with those of the project participants, staff, or funding agents, which may be in direct conflict with the former. We shall discuss other viewpoints in the section on project assumptions and context.

Statements regarding goals and objectives from the government or private agency perspective usually can be obtained by interviewing key individuals who have primary responsibility for planning and developing the project, and from published and informal project documents and government policy declarations. In fact, if you as analyst have not been part of project planning from the beginning, this is a good opportunity to become thoroughly familiar with the manner in which planning took place, and with the assumptions underlying the project. You should request a full project planning record, a copy of all project documents, a copy of the national development plan (or its equivalent), all relevant research and evaluation reports, statistical reports, and other related information. In addition, this is the time to begin listing individuals who can provide relevant social or technical information, and to begin collecting similar studies conducted elsewhere from which pertinent cost and outcome data could be gathered.

A second method for identifying project goals and objectives is to examine the project in detail as it operates and see what it is doing. You, as analyst, can infer what the project is trying to achieve by observing what events take place. The inferences can be discussed with the project directors and a consensus on intended project objectives can be reached on this provisional basis.

After identifying and classifying project goals and objectives, you should make certain that both learning and skill application objectives are stated with reasonable specificity in order to determine progress towards their achievement. Project objectives should first specify the precise target group for which the project is intended. Next, there should be some indication of the time period in which the intended change is supposed to occur. Objectives can also be stated in terms of precise behaviors such as the level at which individuals are expected to perform or the magnitude of the intended change. For example, previously illiterate adult participants will read at a Standard 2 (second grade) level of comprehension by the end of the first year.

The more detailed the information about what is to be measured, the more accurate the measurement is likely to be. Specification of a target group and an indication of the expected pace of change, and performance level, provides primary criteria for the development and selection of measurement instruments. However, if project objectives are specified in too much detail, what is gained in measurement accuracy may be lost in recognition of overall project impact. Many NFE projects are broadly aimed, seeking to help participants with problem solving and to encourage them to take positive action in coping with community/farm/family problems. In cases in which the intended directions or areas of change are clear, but not the desired magnitude, you will have to infer on your own how the impact of the project may be measured.

In any case, be careful to avoid the danger of selecting those objectives which are easily measurable over those which are more difficult to assess, but which may be more significant. Thus, as NFE project analyst, you are advised to follow this standard procedure:

(1) to identify project aims by interviewing project designers, by reviewing project documents, or by examining project operations,

(2) to specify all the key elements upon which the project is intended to have an impact,

(3) to state the target group to be affected, the pace of change and the minimum performance level to be attained when these have been determined by the project designers.

It is also important to note that while project evaluation begins with the identification of intended project impacts, final evaluation

SCOPE Worksheet 1.1 (page 1)

IDENTIFICATION OF PROJECT GOALS AND OBJECTIVES

Project Name: ______________________ Date: ______________________

PROJECT OBJECTIVE	Target Group	High Priority	Low Priority
Learning Objective LO 1.			
Skill Application Objective SO 1.			

SCOPE Worksheet 1.1 (page 2)

IDENTIFICATION OF PROJECT GOALS AND OBJECTIVES

Project Name: ______________________ Date: ______________________

PROJECT OBJECTIVE	Target Group	High Priority	Low Priority
Skill Application Objective (continued)			
SO 1.			
OVERALL DEVELOPMENT GOAL			
G 1.			

focuses on the actual effects of the project upon learning and upon socioeconomic conditions, whether or not these were planned.

4. Establishing Priorities for Project Aims

When faced with a large number of project aims, you should establish priorities for them. This will enable you to focus on assessing the most important outcomes, if evaluation time is particularly short.

Ordering project aims can be accomplished by examining the priorities stated in national policy statements and project documents or expressed in previous discussions with key project designers. Project aims can be listed simply as "high" or "low." If the list of aims is especially complex and if objectives are mutually conflicting, you may wish to provide additional categories for intermediate levels of priority.

It is now time to list the ordered goals and objectives for your project. Use Worksheet 1.1, Identification of Project Goals and Objectives, to record this information. The examples presented in Table 1.1 can be used as a guide for specifying project aims.

It is very important that the list of ordered goals and objectives be validated by review with appropriate project designers, and necessary revisions made. The list is now ready for a secondary review by representatives of funding agencies, by project managers and personnel, and by project participants. A review facilitates the identification of project elements designed to achieve intended goals and objectives, and helps to uncover goal conflicts which may hamper accomplishments.

B. SPECIFY PROJECT DESIGN AND ORGANIZATION

While you should not get bogged down in too much detail at this stage, a simple but systematic review of project design and organization at the start of the investigation can be extremely useful. Such a review provides a first step in determining if the project follows a feasible educational approach for achieving its goals and objectives, and if it is technically and administratively sound. It also facilitates preparation of the evaluation strategy by clarifying some of the factors which will require special attention in the analysis of project costs and outcomes.

By specific project, we are referring to some explicitly defined investment activity or system of activities in which a certain group of participants learns certain skills in a particular way, using specific materials and techniques during a set period of time. Usually, it will have some geographic focus and an administrative structure which can be defined.

In most cases, the nature and delineation of the NFE project to be submitted to economic analysis will be obvious. In other cases, the project under consideration may be a component of a larger program, may "piggyback" on the physical and staff resources of a local or national institution, or may have several agencies responsible for its funding and/or management. A careful description of the project at an early stage in the investigation can help to avoid serious misunderstandings later on.

SCOPE Worksheet 1.2 (page 1)

REVIEW OF PROJECT DESIGN AND ELEMENTS*

Project Name: ______________________ Date: ______________________

I. PROJECT HISTORY AND STRATEGY

A. Historical Development (how project came about and how project was planned):

B. Current Stage of Project Development (in general, in various locations):

C. Overall Strategy (basic principles in developing the project):

II. PROJECT ELEMENTS

A. Audience or Participants (primary and secondary)
   1. number:
   2. project relevant characteristics (age, sex, income, education level, farm size, etc.):

B. Area Served

C. Timing and Duration

*Partially derived from Agar, Moock and Kline (1977)

SCOPE Worksheet 1.2 (page 2)

D. Project Activities

1. Planning and Development (research, coordination, etc.):

2. Selection and organization of instructional methods (lecture, group discussion, radio, demonstrations, etc.):

3. Preparation and production of learning materials (curriculum design, writing, pre-testing, etc.):

4. Recruitment of participants and provision of training incentives (radio campaign, free housing, etc.):

5. Recruitment and training of staff

6. Acquisition, maintenance and perational management of support commodities (equipm , buildings, vehicles, land, etc.):

7. Monitoring and evaluation:

8. Other:

III. MANAGEMENT FRAMEWORK

A. Administrative Structure (central and field):

B. Sources of Funding:

IV. LINKS AND OVERLAP WITH OTHER PROGRAMS/AGENCIES/INSTITUTIONS

The minimal information needed to describe any NFE project is listed on Worksheet 1.2, Review of Project Design and Elements. Complete the form by referring to project documents, your interviews with project personnel, and your observations of the project's operation.

C. REVIEW UNDERLYING ASSUMPTIONS AND PROJECT CONTEXT

1. Reviewing Underlying Assumptions

In our discussion of project goals and objectives, we talked about a hypothetical chain of events starting with project resource inputs, continuing to learning outcomes, and the transfer and application of the learning experience to the goal of national development benefits. At each link in the chain, however, there are certain human and technical factors outside the scope of the project which strongly influence the outcome of the activity.

The design of the NFE project rests upon a series of assumptions about the interplay of external factors and about the way they will contribute to the success of the project. By making these assumptions clear and by examining them in the light of the socioeconomic context in which the project takes place, we can determine whether the expected outcomes are reasonable.

You can begin the identification of underlying assumptions by reviewing project documents and by interviewing project designers. The objective is to see what outcomes can be expected to occur at each level in order to achieve a successful result. At the immediate level of educational outcomes, you might ask what factors are expected to influence the timely arrival and use of resources. Another question might be what assumptions have been made regarding attitude, motivation, and skills of the instructors and participants in the project.

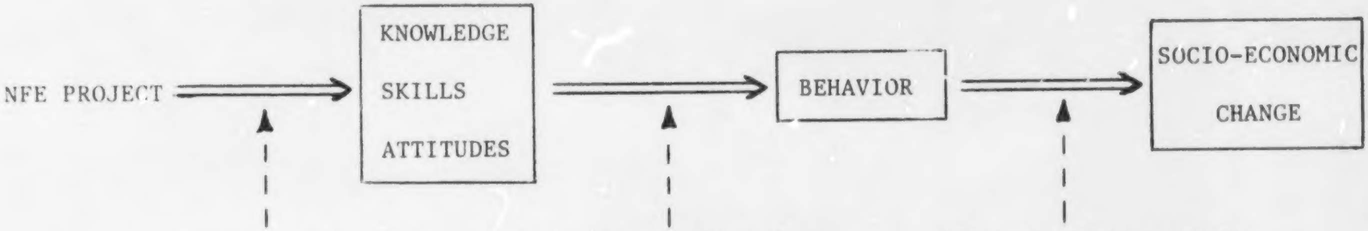
Again, at the level of skill application outcomes, you should review with the project designers their expectations about the conditions affecting the use of new knowledge and skills. These conditions include the technical and physical potential of the local environment, employment prospects, the availability and nature of such elements as credit, raw materials, health facilities, land tenure, and so on. They also include the self-perceived needs and technical capacities of participants in their particular social setting.

Perhaps the most difficult assumptions to identify are those underlying the project's expected contribution to national or local development goals. These assumptions center upon a host of political, social, and economic conditions which are external to the project, but which are expected to facilitate the linkage between skill application and wider societal change. These may include expectations about national political ideology, the nature of marketing channels, administrative resources, and political policies and practices. Such factors may be thought to influence relationships such as those between marginal agricultural productivity and income redistribution, literacy and improved health practices, or increased civic participation and greater equity in the distribution of national or district social services.

NFE projects for planned social change are built upon many assumptions about the nature of the host society (see Figure 1.2). You, as analyst, should attempt to identify at least the most important assumptions about factors which would seem to directly affect the outcome of the project.

Figure 1.2 Chain of Outcome Events and Underlying Assumptions

What is expected to occur at each stage in order to achieve a successful result?


NFE PROJECT
KNOWLEDGE
SKILLS
ATTITUDES
BEHAVIOR
SOCIO-ECONOMIC
CHANGE

What assumptions have been made about...

-project coordination
-adequacy of resources
-timing of resources
-content appropriateness
-participant knowledge/motivation/background
-etc....?

What assumptions have been made about...

-social/technical aspects of the local environment
-provision of relevant materials/supplies
-fit with local development activities
-etc....?

What assumptions have been made about...

-national development policies and practices
-political will behind the project
-etc....?

Once these assumptions are made explicit and are reviewed openly with the project designers, the next step is to gauge how realistic they are. This can be accomplished by a general review of the context in which the project is set. *This review should not be time-consuming*. At this stage, you should be seeking a feel for the situation which will allow a preliminary understanding of factors which will deter or encourage success. Naturally, there is no substitute for carefully planned, quality research. However, we believe that a relatively rapid and low cost gathering and review of data of this sort can be valuable when combined with familiarity with the study area.

2. Reviewing Project Context

There are three components of a project which the analyst should review as early in the investigation as possible. These are: the social and technical aspects of the local environment, the needs and capacities of the target audience, and national development policies and practices. We shall briefly consider each in turn, and indicate possible sources of information for a first general review.

Interaction among the technical and human characteristics of the local setting generates a unique social situation with its own particular development opportunities and constraints. Lack of understanding of these factors is a major cause of poor performance in NFE projects. For example, it is not uncommon that a change in farmer behavior is sought through a program of basic education, while there is little understanding among planners of whether or not the incentives exist which would create such a change. Necessary factors, in addition to basic education, might include improvements in marketing and input delivery systems, land allocation, the development of roads and water supplies, and the availability of seed, fertilizer, and insecticide.

Ideally, you should be briefed as thoroughly as possible not only in regard to community characteristics, but as to the manner in which the community is linked with the wider society. Some of this information may be available in the form of local research reports or national statistics analyzed by district or some smaller administrative unit. In addition, the original project planning documents may contain references to useful information sources.

Presumably the aim and strategy of the project have been geared to a determination of local learning needs and of the technical capacities of the project's clients. The manner in which these needs and capacities were identified deserves close examination.

Learning needs refer to knowledge and skills by which the target audience may improve their understanding of their personal circumstances and take fuller advantage of the opportunities offered by their social system. *Technical capacities* relate to skills, motivation, managerial capacity, the financial and labor capacity of the farm family, and community arrangements for economic exchange.

Good project planning takes into account not only what is technically possible, but what the client perceives to be profitable use of his or her employable resources. In addition, the project design should reflect the manner in which the project activity fits the client's use of resources within the specific social setting. Unfortunately, the identification of real learning needs and technical capacities is a research area in which knowledge is usually very poor.

You should first determine if a formal assessment of participant needs and capacities was performed. If so, the method of assessment should be reviewed for its reliability. As project analyst, you should know how the target group was defined, and how it differs from other community or age groups. You should also know whether their self-perceptions regarding need and capacity were included in the planning process and how this was done. In other words, were theories concerning learning need and technical capacity generated from group discussions, interviews with project clientele, participant observation or other field research techniques, or were they simply the opinions of project planners or of prestigious community members assumed to be spokesmen for their poorer neighbors? Need and capacity statements and implicit assumptions should be cross-checked with broader-based statistical data regarding area or sector development limitations or opportunities. If this information is contradictory, you can begin to specify where the underlying analysis for project planning has been inadequate.

National strategies and practices for development are another important consideration. These include the national political ideology and the resulting policies which provide the guidelines for local organizational choices. Familiarity with the political economy of the host country is an important prerequisite for NFE project analysis in a cost/effectiveness, cost/benefit framework. As analyst, you should be reasonably familiar with the structure of the economy and aware of the political decisions which determine the distribution of national wealth, and who benefits from each type of development activity.

Examination of the country's broad national and local policies, and their consistency with the goals defined for the project's target audience helps determine what can be realistically expected from the project. Policies to be examined deal with land tenure, pricing and marketing, credit and subsidies, wages, trading, and manpower training, among others. Often inconsistent policies in these areas have negative effects on the progress of rural development and upon efforts to raise the standard of living for the poor.

As analyst, you should pay particular attention to the manner in which NFE is related to learning opportunities within the formal education system, to the political forces behind the activity under consideration, and to complementary projects which may influence your particular project's performance. A general overview of this sort may draw heavily upon the readily available data generated by central government agencies. These reports and statistics can then be interpreted through interviews with professionals in planning offices, at the university or in the government.

Before starting the project assessment, be sure to put aside enough time for a general review of project context. By reviewing project context and underlying assumptions in the project design at the outset of the investigation, you can become better acquainted with the study area and the quality of the information readily available. This review will also enable you to determine whether the project design is suited to its goals and objectives and its clientele, and whether the project fits into a broader strategy for meeting the needs of the target audience.

SCOPE Worksheet 1.3

REVIEW OF PROJECT ASSUMPTIONS

Project Name: ____________________ Date: ____________

PROJECT AIMS	ASSUMPTIONS	POSSIBLE INTERFERING FACTORS
Learning Objectives		
Skill Application Objectives		
Overall Development Goals		

Use Worksheet 1.3, Review of Project Assumptions to describe what you see as the underlying assumptions in the project design for each level of intended outcome. Based upon your general review of project context, comment upon factors you feel may affect the realization of these assumptions, and will require special attention during the course of the investigation.

D. DEFINE ALTERNATIVES FOR DECISION-MAKING

We have said that cost/effectiveness, cost/benefit analyses are techniques which aid the decision-maker in judging the "profitability" or economic worth of an NFE project. The criteria for such judgment must rest upon the alternative uses of project resources which the decision-maker has at his disposal. We emphasize the phrase, at his disposal, because decision-making in the public sector in a complex area such as NFE typically takes place not only within a bureaucratic hierarchy, but cuts across many development institutions. By confining the investigation to available alternatives, it is possible to limit the many questions which could be asked about the project, and reduce the analytical work required.

In NFE projects with greatly dispersed management and funding responsibility, the alternatives for any given decision-maker will be limited by the area and level of his administrative duties. For example, the range of choices open to a project manager who works within the limits of a specific project will be different from those of a national education planner who may choose from among many projects. In a similar fashion, the options available to a Ministry of Education planner will be constrained by the budget and organizational structure of that Ministry, while a planner in the Office of the President may be able to select from a wide range of alternatives across sectors.

Figure 1.3-Division of Public Sector Decision-Making as Related to Non Formal Education

Decisions of Policy Maker:

- determines development aims
- sets development priorities (emphasis on rural development rather than on capital intensive urban transformation, or on small-holder agriculture rather than on large-scale production)

Decisions of Planner:

- sets priorities among sector or subsector areas of concentration
- determines resource allocation among geographic areas
- sets priorities among social service and production programs
- identifies projects and allocates resources among them
- formulates overall project design and relates project to complementary sector or regional activities

Decisions of Project Manager:

In general, to decide how and when to use resources made available by the planner

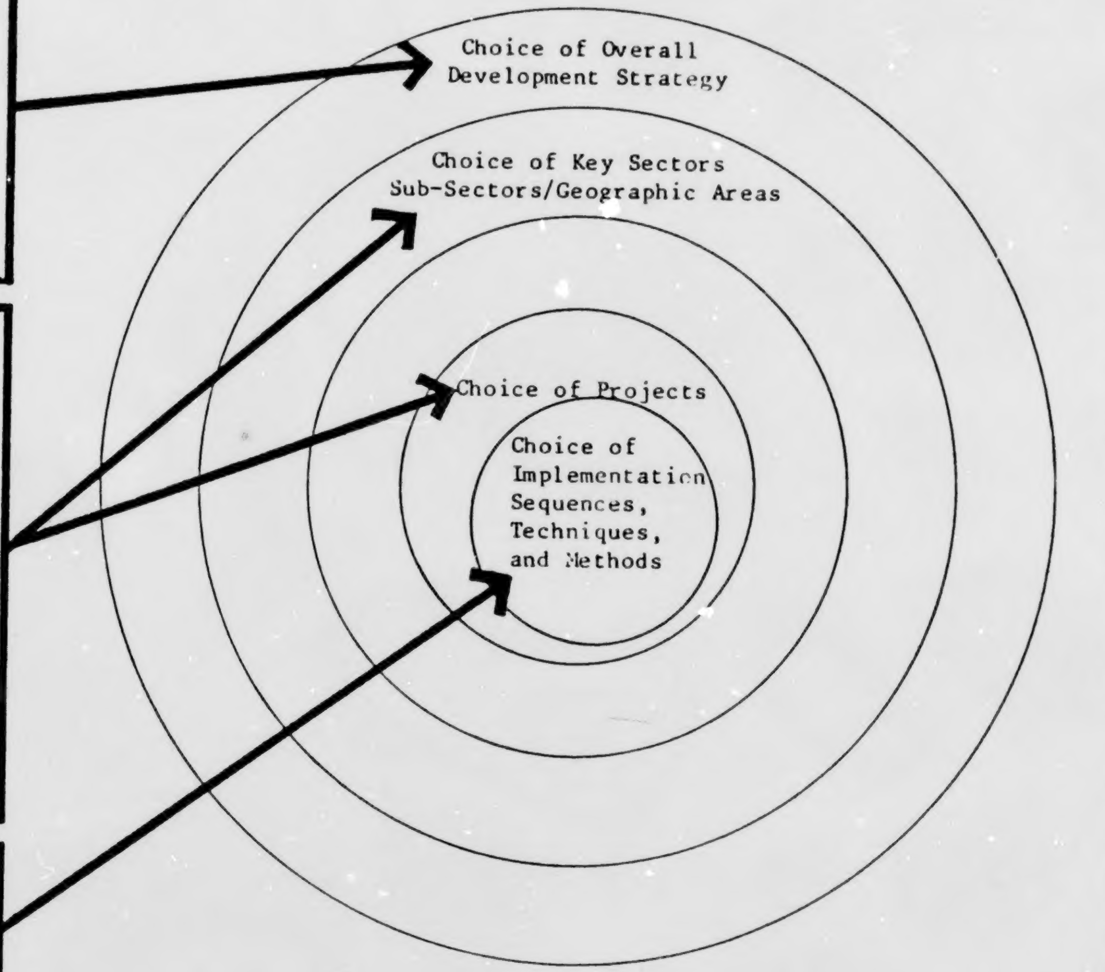

Choice of Overall Development Strategy
Choice of Key Sectors Sub-Sectors/Geographic Areas
Choice of Projects
Choice of Implementation Sequences, Techniques, and Methods

Figure 1.3 illustrates the division of decision-making responsibility between policy makers, planners, and project managers as related to NFE. In an effort to keep the diagram simple, no attempt has been made to distinguish between national planners, sectoral planners, agency planners, or district planners. The choices that different types of planners can make are obviously limited by the bounds of their decision-making responsibility and the resources available to them. Furthermore, for any given NFE project, it is possible for two or three of the key roles to be played by the same individual, and it is possible for the same role to be played simultaneously by individuals in different ministries or agencies. The more project administrative roles are spread among individuals and agencies, the more limited are the alternatives and the narrower are the concerns of the decision-makers at the lower planning and implementation levels. In NFE projects, critical decisions are typically made at these levels.

A clear and realistic presentation of the alternatives available to the particular decision-maker will help to focus the questions which the investigation is to consider. Let us suppose, for example, that the analysts were asked to evaluate an adult basic education project for the Adult Literacy Division of the Ministry of Education. The types of options available to planners in this Division are confined to providing adult literacy within the designated Division budget. The planners wish to know specifically if the project follows the least costly alternative for reaching its target audience and for achieving its specific project aims. In this case, such issues as whether literacy programs are better alternatives than increasing agricultural programs, or whether adult education should be emphasized over a more rapid expansion of primary schools, are immaterial for the decision-makers in the Division. Their options are limited by the development strategy chosen at a higher level.

In those cases where project analysis is intended for multiple decision-makers at different administrative levels, the analyst must be certain to verify the purpose of the investigation and the alternatives to be considered with all the parties concerned.

You are now familiar with the aims, organization and context of the project which you intend to analyze. These factors should help you to identify the major purpose or purposes of the investigation. Depending upon who needs the information, the available administrative alternatives, and the timing of the investigation in the life cycle of the project, economic analysis can be used to answer the following questions:

... should this project be funded?

... should this project be implemented?

... is this a profitable investment?

... is this project compatible with broader strategies for national development and growth?

... how can the efficiency of this project be improved?

... how can the cost of this project be reduced, while the level of outcomes remains the same?

... should this project be continued?

... should this project be expanded?

... should this project be replicated elsewhere?

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SCOPE Worksheet 1.4

IDENTIFICATION OF QUESTIONS FOR DECISION-MAKING

Project Name: ______________________________ Date: ____________________

DECISION-MAKER	ORGANIZATION AND LEVEL OF RESPONSIBILITY	KEY QUESTIONS	SPECIAL AREAS OF CONCERN

Use Worksheet 1.4, Identification of Questions for Decision-Making, to state explicitly the key features of the alternatives under consideration. Identify the level of administrative responsibility for each decision-maker to whom you are responsible, and the particular areas of concern.

E. ESTABLISH A TIMELINE FOR REPORTING THE INVESTIGATION

The fundamental criterion for an economic analysis of investment projects is that the information be functional and timely enough to actually be used. This means that the appropriate information must be at hand when it is required. It is useful to develop a reporting time schedule at the outset of the investigation. Such a schedule might include interim reports or reports of preliminary findings, as well as a final report. It should be developed in conjunction with the sponsors of the investigation.

More often than not, the day-to-day operational pressures of decision-makers, or their need to get out a first draft plan to include projects in next year's budget, necessitates a reporting timeline shorter than the analyst may desire. When this is the case, both the analyst and the decision-makers to whom he or she is accountable must be ready to accept a limited scope for the investigation, imperfections, and the use of rough approximations as the price for timely project management information. However, by using a timeline to pace oneself and by planning the evaluation with care, the analyst can make the best of a difficult situation and ensure that useful information is available at the time project decisions have to be made.

SCOPE Worksheet 1.5

REPORTING TIMELINE

Project Name: ______________________________ Date: ________________

REPORT RECIPIENT	TYPE OF REPORT	DUE DATE

To establish a timeline for reporting your investigation, you should consider all the resources available: the analysts' time, the services available for of data collection, scheduling problems, and most important, the information needs of those who will use the evaluation. It is possible to cut back on the plan of investigation knowing that the decision on what to cut is an informed decision -- informed in terms of the several alternatives available among the established priorities. What actually gets done is now what finally was decided upon after all serious possibilities were considered.

At this point, we suggest that you review the remaining steps in Section D. Ask what data must be collected -- in what form and by whom -- and what are the requirements for analysis. These needs should then be matched with the time, money, and personnel resources available for the investigation.

After conferring with the major report recipients, complete Worksheet 1.5, Reporting Timeline.

What is Accomplished by Completing These Preliminary Tasks?

In defining the project and specifying the aim of the investigation, you have taken the first step to ensure that you have a clear understanding of the nature of the project and the context in which it is set, and that the investigation is directed to the information needs of the appropriate decision-makers. Furthermore, this preliminary review of the project in its administrative and social setting has increased your familiarity with the nature of the data currently available and has provided initial working contacts with the various agencies and individuals concerned. We turn now to the second major phase of the SCOPE strategy which focuses on specifying project resource inputs and obtaining estimates of project cost.

CHECKLIST OF SUBSTEPS AND TASKS FOR DEFINING THE PROJECT AND SPECIFYING THE AIM OF THE INVESTIGATION (STEP 1)

SUBSTEPS	TASK	COMPLETION DATE
A. Identify what the project is intended to accomplish	A.1 Identify and classify project goals and objectives A.2 State objectives with reasonable specificity A.3 Order goals and objectives according to priorities expressed by decision-makers A.4 Identify key questions to be answered	
B. Specify project organization and design	B.1 Describe project's history, operational elements, and organizational framework B.2 Determine if project design is technically and administratively sound	
C. Review underlying assumptions and project context	C.1 Identify major underlying assumptions at each level of intended outcome C.2 Review context in which project functions C.3 Determine how learner needs and capacities were identified C.4 Identify factors which may affect the realization of assumptions	
D. Define alternatives for decision-making	D.1 Identify alternatives D.2 Identify specific areas of concern for decision-makers	
E. Establish a timeline for reporting the investigation	E.1 Review resources available for the investigation E.2 Draw up a reporting timeline with the major report recipients	

SECTION D

STEP 2

LIST PROJECT RESOURCES

Once the purpose of the evaluation and the nature of the project have been established, we are ready to begin the steps for costing the project and relating these costs to project outcomes. Under the SCOPE framework, the first thing to do is to systematically describe the project resources (sometimes called inputs).

The most important thing to remember when preparing a list of the resources required by a given project is that it must be as complete as possible. Every resource used in the project should be included regardless of who bears the cost. For example in a project sponsored by the Ministry of Education for training students in the operation and maintenance of farm machinery, some inputs such as time and books will be the responsibility of students and their families; others such as instructor's time, classrooms and equipment will be the responsibility of the Ministry of Education; while still other resources such as farmland and roads may be provided by other governmental agencies. Although only the goods and services provided by the Ministry of Education are reflected in the project's budget, all the resources together comprise the social cost of the project.

Collecting a complete list of resources not only prompts the analyst to include all resources relevant to immediate decision-making needs, but provides a basic foundation for analysis of the project by other levels of government or other communities interested in adopting the project to their particular circumstances. In all cases, failure to list every relevant input will understate the cost of the project to the economy and could lead to poor decision-making.

A. CLASSIFY RESOURCES

Resources can be categorized in several ways. For the evaluation of most kinds of NFE projects, resources can be classified and listed simply by type under the general economic headings of labor, fixed plant, equipment, land, and materials and supplies:

Labor -- includes the hours of instruction and other work by skilled and unskilled project staff members; the time of project administrators, advisors, and consultants; and the time spent by the participants (students) in the project.

Fixed Plant -- includes classrooms, offices, laboratories, storage and other building and facility space used by the project.

Equipment -- includes all major pieces of durable equipment such as buses, tractors and other farm equipment, communication hardware, laboratory and classroom furnishings.

Land -- includes land purchased or allocated for project construction, operation or training.

Materials and Supplies -- include the things which are used during the project and which would have to be replaced for the next set of students such as workbooks, paper, seed, fertilizer, gasoline and wood.

At a slightly higher level of complexity, resources can be categorized by a particular activity within a project first, and then listed by type. For example, it would be helpful to list resources by activity if the project involved many phases or a complex design. In this way there

SCOPE Table 2.1

PROJECT RESOURCES IN AN ILLUSTRATIVE NFE PROJECT TRAINING FARMERS IN THE USE OF FARM EQUIPMENT

RESOURCES	DESCRIPTION	SOURCE OF FUNDING	UNITS AND TIME USED						ASSUMPTIONS AND MEASUREMENT PROBLEMS
			YEAR 1 (SET-UP YEAR)		YEAR 2		YEAR 3		
			#Units	Time Used	#Units	Time Used	#Units	Time Used	
Labor									
Skilled									
Administrators	Level VI	Ministry	1	80 days	1	120 days	1	120 days	
Mechanics	Levels III,IV	Ministry	2	40 days	2	480 days	2	480 days	
Consultants		Ministry	2	80 days	1	10 days	2	40 days	
Unskilled									
Aide	Level II	Ministry			2	480 days	2	480 days	each farmer devotes an est. 4 hrs/day to course
Custodian	Level I	Ministry			1	240 days	1	240 days	
Trainees		Ministry			30	3,600 days	30	3,600 days	
Fixed Plant									
Classrooms	5m x 7m	Local govt			1	1,920 hours	1	1, 920 hours	
Storage barn	10m x 20m	Ministry			1	Full Time	1	Full Time	
Office	4m x 5m	Ministry	1	Full time	1	Full Time	1	Full Time	
Equipment									
Tractors	John Deere Model D	Ministry			2	1,920 hours	2	1,920 hours	
Land									
Demonstration Fields	20 acres	Interior Dept.			20 acres	Full Time	20 acres	Full Time	
Materials and Supplies									
Gasoline		Ministry			25,000 liters		25,000 liters		
Paper,pencils,etc		Trainees			30 sets		30 sets		—
Manuals	Grades 1 & 2	Trainees			30 units (grade 1)		30 units (grade 2)		

SCOPE Table 2.2

PROJECT ADMINISTRATION COSTS[a]

I. Annual Costs of Project Administration at Stanford: (all figures given include direct and all indirect costs)[b]		
Principal Investigator - 6% of full time	$ 2,480	
Project Manager - 50% of full time	11,680	
Secretary - 50% of full time	5,600	
Administrative services - 15% of full time (covered by indirect costs)	0	
University functions - purchasing, shipping, accounting (covered by indirect costs)	0	
Telephone, office supplies, etc.	3,520	
Computer time	3,680	
Travel to Nicaragua for administrative purposes (25% of four trips)	1,120	
Subtotal		$28,080
II. Annual Costs of Project Administration in Nicaragua:		
Expatriate Advisor - 33% of full time	$12,160	
Nicaraguan Project Director - 50% of full time	4,000	
Secretary (bilingual) - 100% of full time	2,800	
Subtotal		$18,960
III. Total Annual Costs of Project Administration		$47,040

a. Costs incurred in cordobas are exchanged into U.S. dollars at the rate of 7 cordobas per dollar.

b. Indirect costs at Stanford University are 47% of base costs.

SOURCE: Jamison, Klees, Wells 1978.

would be less chance for resources to be forgotten or counted more than once. Once all resources were listed by activity and type, they could, for the sake of simplicity, be combined into a summary listing by type only.

Tables 2.1 and 2.2 illustrate the two methods of categorizing resources. Table 2.1, representing an imaginary project, categorizes the resources by type only. Table 2.2, representing a real example from the Nicaraguan Radio Mathematics Project (Jamison, Klees, and Wells, 1978) categorizes the resources by activity and type. In Table 2.2, resources for one activity (project administration) among many (including program preparation, radio transmission and radio reception) are listed. A summary table of resources for this project could be constructed which would group all of the resources of the same type from all of the different activities. Such a summary table would look much like our Table 2.1.

B. LIST AND DESCRIBE RESOURCES

Worksheet 2.1 has been designed to assist you in listing your project resources. The format of Worksheet 2.1 is the same as that of Table 2.1. As you can see by looking at Table 2.1, the format includes more than a mere listing of the resources by type. It also includes a significant amount of descriptive information about each resource. Such information is included in order to assist the evaluator in assigning cost estimates to the resources later on. In general, the descriptive material should help the evaluator answer the following questions:

Project Name: ____________________

Date: ____________________

SCOPE Worksheet 2.1

REVIEW OF PROJECT RESOURCES

RESOURCES	DESCRIPTION	SOURCE OF FUNDING	UNITS AND TIME USED						ASSUMPTIONS
			YEAR 1		YEAR 2		YEAR 3, Etc....		
			#Units	Time Used	#Units	Time Used	#Units	Time Used	
Labor Skilled Unskilled									
Fixed Plant									
Equipment									
Land									
Materials and Supplies									

EVALUATOR'S QUESTIONS ABOUT PROJECT RESOURCES

Question	Column in Table 2.1
1. What are the specific qualities of the resource, in terms of skill level, grade, model, brand, etc.?	DESCRIPTION
2. What is the source of funding for this resource?	SOURCE OF FUNDING
3. What quantities of each resource are used in the project?	UNITS AND TIME USED (#UNITS)
4. When are the resources needed and for how long?	UNITS AND TIME USED (Time Used)
5. What special assumptions must be made about the project resources listed?	ASSUMPTIONS

It should be noted that the relevant time period for listing resources includes the period of planning and setting up the project as well as the years in which the project is in operation. This preliminary period is referred to in the table as Year 1 (Set-up year), although the period could be longer or shorter than a year.

Now let us examine some of the details in Table 2.1 more carefully. As suggested by the title of the Table, the sample project is an NFE course designed to train farmers in the use of farm equipment. It is a three year project including a "set-up year." Among the project resources listed in the first column are two skilled mechanics. One of the mechanics is of level III; the other of level IV (column 2). They are both funded by the government ministry (column 3). During the set-up year, they worked for a combined period of 40 days (column 4). During the two years of project operations, they worked a combined total of 480 hours each year (columns 5 and 6). These details are apparently firm since there are no special assumptions. Similarly, we can see that two Model D, John Deere tractors, funded by the Ministry were used during the two years for a total of 1920 hours each.

Since Table 2.1 (and Worksheet 2.1) call for summary information about resources, it is often necessary to start listing resources in more detail on preliminary worksheets. Table 2.3 shows a more detailed listing of the "skilled labor" category of the farmer training project. As you can see from the table, the 40 days spent by the skilled mechanic instructors in planning and setting up the course actually represents 30 days' time from mechanic A and 10 days' time from mechanic B. This distinction is an important one for the eventual task of costing, since the two workers are probably paid at different rates. Evaluators should use as many supplementary worksheets as necessary in order to record such important details about project resources.

C. SPECIAL CONSIDERATIONS

There are several difficulties that may arise in preparing a list of resource requirements for a particular project. The most common problems concern the treatment of resources whose costs are not included directly in the project budget but rather are contributed or donated from sources other than the sponsoring agency. Such inputs may come from both the private sector (through contributions of time, goods, or money) and as a result of other government projects. If, as often is the case, individual government agencies assess a project only on the basis of the costs borne directly by the agency, costs may be seriously understated, making the project appear less costly than it really is. Thus, in program evaluation it is important that the evaluator give careful consideration to resources

SCOPE Table 2.3

DETAILED BREAKDOWN OF SKILLED LABOR USED IN ILLUSTRATIVE NFE PROJECT

TRAINING FARMERS IN THE USE OF FARM EQUIPMENT

RESOURCES	DESCRIPTION	SOURCE OF FUNDING	UNITS AND TIME USED					
			YEAR 1 (SET-UP YEAR)		YEAR 2		YEAR 3	
			#Units	Time Used	#Units	Time Used	#Units	Time Used
Labor Skilled								
Administrator	Level VI	Ministry	1	80 days	1	120 days	1	120 days
Mechanic A	Level IV	Ministry	1	30 days	1	240 days	1	240 days
Mechanic B	Level III	Ministry	1	10 days	1	240 days	1	240 days
Consultant A		Ministry	1	50 days	1	10 days	1	25 days
Consultant B		Ministry	1	30 days	1	0	1	15 days

which are contributed, those which are shared with other projects, and special features of the environment in which the project takes place. On the other hand, it is important that costs not be overestimated by counting resources more than once. The issue of double counting must also be addressed by the evaluator.

1. Contributed Resources

Contributed resources can often comprise a very important part of most NFE projects. Broadly defined, the term includes the services provided by volunteers and the time and expenses spent by the participants -- for example, students or trainees -- that are not paid by the sponsoring agency. When the contribution is not monetary -- for example, volunteer teaching and student time -- it may be overlooked. Yet, clearly these resources have value and in most cases cannot be assumed to cost nothing.

Similarly, special costs may often be understated when a project component is part of the government. In particular, the sponsoring agency often acquires government-owned land or the services of government employees at no cost and hence attributes no cost to the land in the assessment of project costs. On the other hand, if the agency had to buy the land or hire the personnel, the costs would be recognized as a part of total project costs. Since the land or services could be, in most cases, put to other productive uses, their use by the project represents a cost to the economy and should be listed as project resources.

2. Shared Resources

Shared resources are commonly found in NFE projects. For example, the same teachers and facilities which are employed in formal educational activities are often used by NFE projects as well. In such cases these resources are often ignored since it is believed that such costs are borne entirely by the formal education project. However, as we shall see in Step 3, the allocation of shared resource costs across projects is specific to each situation and the costs cannot be assumed to be zero. In all cases the resources should be listed so that the appropriate prices -- even if they are zero in some cases -- can be determined and documented.

3. Environmental Features

The environment in which the project is implemented should also be examined to see if there are particular technical or physical characteristics which contribute to its operation. Frequently, we observe that a project may succeed in one place but fail in another. Often when the project's resource requirements are carefully considered, the environment supporting the projects may explain the differences. For example, a training center built near a road requires fewer resources for road construction than another built in a remote area. Similarly, when communication channels are available, or when participants in a literacy project are well nourished, the resources needed for agricultural policy information campaigns may be substantially reduced. Large scale government projects in areas such as transportation, communications and power plant construction often contribute to the base that supports NFE projects. The evaluator should be aware of such governmental projects in the region of the NFE project, and while not counting them as specific resources, carefully take note of them and consider them when interpreting the results of analyses and recommending possible replication of the project in different (perhaps less well endowed) environments.

4. Avoidance of Double Counting

Just as it is important that all the resources required by the project be listed, it is also essential that each resource be counted only once. Otherwise, project costs will be overstated and the project may appear less economically attractive than is the case.

Example 2.1

An NFE project training master carpenters requires each student to pay $40 for books and supplies each year. The students pay this fee to project officials who, in turn, purchase and provide the necessary books and materials to the students throughout the project. Thus, payments for books and supplies would be considered an expenditure item in the individual budgets of the trainees and the project as well.

Double counting problems usually arise when there is more than one source of funding contributing to the project. When funds are transferred from one source to another for a specific purpose, as in Example 2.1 above, these expenditures for books and materials appear in both budgets. However, it is incorrect to list these resources twice (i.e., double count them) in an overall project evaluation. Only one set of books and materials per student was used by the project, representing a single cost to the economy. The other transactions represent a transfer in financing responsibility for these items and should appear as incoming revenues as well as expenditures in all budget statements but those of the final users (the trainees).

Use Worksheet 2.1, Review of Project Resources, to list and describe project resources.

CHECKLIST OF SUBSTEPS AND TASKS
FOR LISTING PROJECT RESOURCES
(STEP 2)

SUBSTEP	TASK	COMPLETION DATE
List Resources Used by the Project	Prepare detailed worksheets of resources used by the project in each year by category. (Prior listing by activity optional.)	
	Check to see that all resource requirements are listed including those that are donated or shared.	
	Check for double counting.	
	Check that assumptions and estimating techniques are explicitly stated.	
	Prepare summary worksheet of project resources.	

SECTION D

STEP 3

DETERMINE AND ADJUST RESOURCE COSTS

After all the resources required for a particular project have been listed, the next step is to determine their value. This means that the appropriate unit price for each resource has to be individually determined. This process is complicated by the fact that NFE resources often are shared with other projects. In any case, once prices are determined they are multiplied by the quantity of each factor listed under resource requirements. These become the unadjusted costs of the various project resources. Before these cost figures can be used in most analyses they must be adjusted in certain ways in order to account for time factors and possible price distortions. Thus, in this step, we will discuss:

A) Methods of determining the unit price of resources;

B) Ways of figuring the costs of shared resources; and

C) Procedures for adjusting resource costs.

A. DETERMINE RESOURCE UNIT PRICES

Generally, the market price of goods and services is the best approximation of their true value. However, even where market prices are appropriate and available, the project evaluator may have to assess and manipulate several figures in order to determine the "right" price for a resource. These procedures, while relatively straight-forward, require care and judgment on the part of the analyst.

In Table 3.1, we list the unit prices of the resources required for the illustrative farmer training course, which served as an example in Step 2. The units in Table 3.1 are taken directly from Table 2.1. Minor transformations of the units were made according to the assumptions

Table 3.1

QUANTITY AND COST OF RESOURCES USED BY PROJECT

RESOURCE	DESCRIPTION	YEAR 1 (SET-UP YEAR)			YEAR 2			YEAR 3			ASSUMPTIONS
		UNITS OR HOURS	COST PER UNIT OR HOUR	TOTAL COST	UNITS OR HOURS	COST PER UNIT OR HOUR	TOTAL COST	UNITS OR HOURS	COST PER UNIT OR HOUR	TOTAL COST	
Labor											
(Skilled)											
Administrator	Level IV	640 hrs.	3.20	2,048	960hrs	3.20	3,072	960hrs	3.20	3,072	Eight hours per day
Mechanics (2)	Level III&IV	320 hrs.	1.68 (Ave)	564	3,840hrs	1.68(Ave)	6,451	3,840hrs	1.68(Ave)	6,451	
Consultants	Both Level V	640 hrs.	4.00	2,560	80hrs	4.00	320	320hrs	4.00	1,280	
Aides (2)	Level II				1,920hrs	0.48	922	1,920hrs	0.48	922	4 hrs./day
(Unskilled)											
Custodian	Level I				1,920hrs	0.32	614	1,920hrs	0.32	614	
Trainees (30)					28,800hrs	0.32	9,216	22,800hrs	0.32	9,216	
Fixed Plant											
Classroom	5m x 7m				20 hrs. per week/ 40 weeks/ Year	12.50 per week	500	(same as Year 1)	12.50 per week	500	
Storage Barn	10m x 20m				One year	10.00/mo.	120	One year	10.00/mo.	120	
Office (1)	4m x 5m	fulltime	20.00/mo.		One year	20.00/mo.	240	One year	20.00/mo.	240	
Equipment											
Tractors (2)	John Deere Model D				1,920hrs	2.00/hr.	3,840	1,920hrs	2.00/hr.	3,840	
Land											
Demonstration Fields	20 Acres				20 Acres fulltime	425 per year	425	20 Acres fulltime	425 per year	425	
Materials & Supplies											
Gasoline					25,000 L.	0.25/L.	6,250	25,000 L.	0.25/L.	6,250	No development costs for manuals
Paper,pencils					30 sets	0.20/set	6	30 sets	0.20/set	6	
Manuals	Grades 1&2				30 units	3.00/unit	90	30 units	3.00/unit	90	

specified. For example, days were transformed into hours, assuming an eight hour day. Such assumptions should always be made explicit and tested for accuracy. Since some of the skilled laborers may actually work considerably less than eight hours a day, their actual cost to the project may be overvalued.

The unit prices for the resources in Table 3.1 are fictitious but reasonable. The logic behind each calculation is presented in the following passages. As you follow the logic of costing the resources in our example, use Worksheet 3.1 (which is in the same format as Table 3.1) in order to calculate the unit costs of the resources you listed in Worksheet 2.1.

1. Unit Costs for Labor

The costs of labor, both skilled and unskilled, include not only salaries, but also the monetary value of the fringe benefits (if any) provided for staff members such as meals, pension contributions, housing and medical care. All of these costs should be documented and totaled to determine the unit cost for each classification of labor for each year of the project. Example 3.1 illustrates how this could be done for the skilled mechanics in our hypothetical farmer training course.

Example 3.1

The NFE farmer training course employs two skilled mechanics as instructors in the use of farm equipment. Both mechanics are employed by the Agricultural Ministry at Civil Service salary levels IV ($3,600 per year) and III ($3,000 per year) respectively. In addition, each technician is provided with a housing subsidy ($60 per month for mechanic A; $50 for mechanic B), lunches (valued at $0.30 per workday for both) and family medical care (valued at $16 per month for mechanic A; $9 per month for mechanic B).

During the set-up year, mechanic A is employed 30 days by the project while mechanic B is employed only 10 (see Table 2.3). During the two operational years of the project, the mechanics work 240 days each.

The information from Example 3.1 is summarized in Table 3.2, a supplementary worksheet of the kind you could use in calculating the details of your labor costs. The cost per hour in this table is determined by dividing the total earnings (salary and benefits) by the total number of working hours in a year. Since the project should only be charged for actual numbers of hours worked, the total cost for mechanics will be the cost per hour times the hours worked.

Once detailed calculations of this sort have been made, they can be transferred to a summary worksheet like our Table 3.1. The hourly rate in that table ($1.68) represents the average of the two mechanics' hourly rates. CAUTION: The total cost for the two mechanics for the set-up

Table 3.2

SUPPLEMENTARY WORKSHEET FOR LABOR COST CALCULATIONS (SKILLED MECHANICS)

Year 1 (Set-up Year)

Staff Member	Salary Level	Salary per Year	Benefits per Year	Cost per Hour	Hours	Total Cost
Mechanic A	IV	$3,600	$1,000	$1.84	240	$442
Mechanic B	III	3,000	800	1.52	80	122

Year 2

Staff Member	Salary Level	Salary per Year	Benefits per Year	Cost per Hour	Hours	Total Cost
Mechanic A	IV	3,600	1,000	$1.84	1920	$3533
Mechanic B	III	3,000	800	1.52	1920	2918

Year 3

Staff Member	Salary Level	Salary per Year	Benefits per Year	Cost per Hour	Hours	Total Cost
Mechanic A	IV	3,600	1,000	$1.84	1920	$3533
Mechanic B	III	3,000	800	1.52	1920	2918

year is not the average hourly rate times the total hours worked, since the two mechanics worked differing numbers of hours. In such a case, the individuals' rates should be multiplied by the hours they worked and then summed:

Mechanic A: $1.84 per hour x 240 hours = $442
Mechanic B: $1.52 per hour x 80 hours = 122
Total Cost: $564.

The unit costs for volunteers including teachers, aides, demonstrators, and other supporting personnel should also be estimated. Even though these people are not paid by the project, the economy has lost the goods and services that would have resulted had this labor been applied to other productive purposes. In the absence of direct salary and benefit data for the volunteer labor, the project evaluator must assess the cost of their time by estimating wages and benefits in likely alternative employment. This can be done by examining the wages and benefits which volunteers received previously and/or by assessing the wages and benefits received by other persons of similar skill, training and background. Example 3.2 illustrates how the costs of two volunteer aides are accounted for in our sample project.

Example 3.2

As part of the NFE farmer training program, two volunteer teaching aides are used in the evenings to help course participants with literacy and computational skills needed to understand and use course manuals and related technical literature (operating instructions, planting information, credit and financial terms, etc.). The two aides are young village teachers whose salary is at level 11. Although they receive no direct pay for their services, they have given up (foregone) the opportunity of teaching night classes at a district school. In this case, unit costs to the project are set at the salary level the teachers would have been paid had they been employed in the evening. (No fringe benefits would be added, since such benefits are only available for full-time work. See Table 3.1.)

Finally, the trainees themselves need to be considered. In estimating the unit costs for the trainees, we should consider not only "out-of-the-pocket" expenses, such as those for manuals and materials, but foregone earnings as well. In our example (Table 3.1) we estimate that the farmers devote, on the average, four hours a day to the course, time which they might have spent in other productive ways. The unit cost of $0.32 per hour might have been computed by calculating the average hourly return to the productive enterprises available to the farmer in the particular region (e.g., handicrafts, working for hire, working more land, etc.).

2. Unit Costs for Fixed Plant and Equipment

In dealing with major capital items such as facilities, buildings, and equipment, it is important to distinguish the costs associated with the use of the capital items from the total costs or purchase price of the buildings and equipment. If, as in Example 3.3, a building is constructed to last 30 years and it is expected to be used for other purposes after the project is concluded, then the entire cost of the building should not be charged to the project. Similarly, when durable equipment such as a tractor is purchased which has a service life longer than the project, charging the project for the full purchase price overstates the value. In this case, the tractor could be sold or rented for other uses at the end of the project. (See Example 3.1)

The relevant unit price for purposes of project evaluation is the cost of services of the buildings and equipment, often called rent, that are directly charged to or indirectly borne by the NFE project. When the classrooms, facilities, or equipment are actually rented, the price paid for rent can be used in most circumstances. When the building and equipment are purchased, estimates of the rent that could be charged for the building and equipment must be made. This can be done by examining the rental history of the plant and equipment used by the project as well as the prices charged on comparable capital items on the open market.

Examples 3.3 and 3.4 indicate methods of calculating unit costs for buildings and equipment owned by the NFE project. In our hypothetical farmer training project, buildings and equipment are all rented or contributed. In the case of the classroom in the example (see Table 3.1), the unit price might be determined according to special arrangements with school and community teachers, since the classroom is "shared" with

Example 3.3

A four room training center with an expected life of 30 years is constructed by the NFE Rural Youth Employment Project. During the five years the project is in operation, all four rooms are in full time use for project administration, for development of literacu and numeracy skills, and for instruction in local business marketing and accounting. At the end of the project, Agricultural Extension Services, which was previously housed in town in comparable facilities at a rent of $150 per month, moved into the building. Since the $150 figure represents the market price of comparable facilities the unit cost of the building each year of the NFE project is $1,800.

Example 3.4

An NFE project demonstrates techniques for growing and harvesting a variety of winter wheat. The project purchases a $15,000 tractor with an expected service life of 12 years. The tractor is used for 2 years and then sold at the end of the project for $11,000. Excluding the time and cost it took to purchase and sell the tractor, the net cost of the tractor's services to the NFE project is $4,000. Assuming that the tractor was used about an equal time in each year of the project, the yearly cost is $2,000.

the school. Since the classroom has already been paid for, the arrangement would include a share of the school's operational costs. Example 3.7, covered in the section on "shared resources," shows how a weekly rent of $12.50 might have been calculated for the use of the classroom. Use of the storage barn in the example might have been donated by a prominent village member. Assuming that it was, and that the barn was rented to a crafts cooperative during the previous year for $10 a month, the unit cost is entered as $10 a month.

The office in the example is actually rented at the monthly rate of $20. The assumption is that during the few months a year that the project is not in operation, the office is not put to any other use. If it is, the value of that use is estimated and subtracted from the yearly rent.

3. Unit Costs for Land

Not all NFE projects will have to consider the costs of land. Only those projects which use land which is in addition to that accounted for as fixed plant; for example, cultivated land used in agricultural projects (but not the land upon which the rented office stands). There are a number of different ways in which the cost of the land used by the project can be estimated. The main considerations in choosing the most appropriate technique are the competitiveness of the real estate in the area and knowledge about former use of the land.

Gittinger (1972) discusses three alternative procedures for valuing land:

1. Valuing the land at its purchase price, and entering the cost of the land purchase once as a capital item at the beginning of the

project. While this is the simplest of the approaches, it may not provide a good estimate of the value of the land's production in a situation where there isn't a competitive market for land, or if, as a result of the project, there is to be a change in land use but not land ownership.

2. Valuing the land at its rental cost and entering it yearly into the project accounts for as long as the project continues. This is a suitable approach where there is a relatively competitive market for rental land.

3. Valuing the land by estimating the net value of lost production, or opportunity cost, and entering that each year as a cost to the project. In the absence of competitive real estate markets this method is usually the best alternative in economic analysis and sometimes the only way to value land costs.

Example 3.5 indicates how procedure 3 above could be used in calculating the cost of the land in our sample project. This procedure assumes that a productive alternative exists and that it has been foregone. Example 3.6 demonstrates that in some cases where project land has not had a history of productivity, the opportunity cost for land can be assumed to be zero.

4. Unit Costs for Materials and Supplies

Materials and supplies can generally be costed in a straightforward manner using the market prices of these inputs. Thus, returning to our earlier example of the farmer training project, if paper and pencils for the participants cost $0.20 per set and 30 sets are used each year of the project, the cost of these items would be $6.00 per year as indicated in Table 3.1.

Example 3.5

The twenty acres of land purchased by an NFE project for training local farmers in the use of farm equipment was formerly used to grow corn averaging a yield of 400 bushels a year. At the current price of $3.00 per bushel, the gross return on the farm land was $1,200 per year.

Production costs for the corn are valued as follows:

100 lbs. of seed @ $0.80 per pound.
1,000 hrs. unskilled farm labor @ $0.32 per hour.
150 lbs. fertilizer @ $2.00 per lb.
50 hrs. two-horse plow @ $1.50 per hour.

Thus, the net value of the corn production lost by using the land for the project is $425, which is the total return on the corn ($1,200) less the cost of the production costs ($775).

Example 3.6

Twenty acres of unproductive government land outside the rural village of Durnan is cleared of brush in preparing for the NFE training program in desert farming. The land is to be used for experimental fields. In this case, the production foregone by using the land for project purposes is negligible and the land costs for the project can be entered as zero.

The analyst should be aware that special circumstances may require adjusting the market prices of some materials and supplies. Resources, such as gasoline, which are subject to significant taxes, subsidies, and foreign exchange distortions, may have market prices that do not reflect their true cost to the economy. Adjustments such as those discussed in part C of this step may be necessary. In other cases, such as for revising and reprinting a manual, the overall costs of some project resources may be shared with other projects. These "joint costs" should be distributed among the various projects.

For example, suppose Project A translates a tractor maintenance manual into a local language and prints not only the 30 copies needed for this project but an additional 30 copies to be used by Project B in a neighboring village. The allocation of the various revision costs -- including necessary labor, equipment, etc. -- between the two projects depends upon Project A's intentions in revising the manual. If Project A would have revised the manual even without its use by other projects, all the costs of revision except the added costs of printing the extra 30 manuals are allocated to Project A. These latter costs are attributed to Project B. If both projects would have independently revised the manual but decided to cooperate, then all costs can be divided between the two projects.

B. FIGURE THE COST OF SHARED RESOURCES

We have just indicated how NFE projects might share resources with other projects. As was shown above, when an NFE project uses a resource (such as a a school building or a truck) jointly with another program, the project evaluator must allocate the costs of the shared resource among the different projects. Since the allocation of costs depends upon the nature of the resources and the circumstances under which it was purchased and used, the project evaluator must collect as detailed information as possible. This information should answer questions such as:

> What are the fixed costs and the variable costs associated with the use of the resources?
>
> What was the primary purpose for which the resource was purchased?
>
> Did the needs of the second user affect the size, design, or timing of the purchase?
>
> When and for how long does each project use the resource?
>
> Is this schedule adjusted to fit the needs of the second project?

Generally, the fixed costs of the resources are allocated to the project which purchased the item for its own use. The additional variable cost associated with the use of the facilities or equipment are then divided among the projects according to their use of the resource. Example 3.7 indicates how this might be done, in the case of our hypothetical project. As the example shows, in some cases the NFE project will use resources that are being used anyway and thus does not add significantly to additional variable costs. In other cases, the NFE

Example 3.7

The NFE farmer training course meets five nights a week for four hours each at the village school. The school is five years old and was constructed using both national and local funds at the cost of $50,000. The variable operating costs of the school, including maintenance and utilities, are approximately $10 per day if the school operates during the daytime only and $15 a day if the school operates also at night. During 5 months of the 10-month school year, the school holds special night classes. The NFE project uses one of the school's 6 classrooms. During the season of night classes, the project's share of the operating costs is very small and is considered to be negligible. During the other five months, the NFE project uses the school alone. During this period, it assumes the entire additional $5 operating cost. According to this arrangement, the average weekly cost to the project for the use of the classroom is as follows:

$0 per week for 20 weeks (5 months) =	$ 0.00
$25 per week for 20 weeks	500.00
	$500.00

$500/40 weeks = $12.50 per week.

Village leaders have decided that in three years the school will be too small to accommodate both the formal and nonformal education programs at night. They are considering building an additional classroom. The cost of the addition would be $5,000. The village leaders have decided that if the NFE project continues at its current rate of classroom usage, it will be asked to assume 25% of the fixed costs of the new classroom in addition to its contribution towards the variable operational costs.

SCOPE Worksheet 3.1

QUANTITY AND COST OF RESOURCES USED BY PROJECT

Project Name:______________________________

Date:__________________________

RESOURCE	DESCRIPTION	YEAR 1			YEAR 2			YEAR 3 ...			ASSUMPTIONS
		UNITS OR HOURS	COST PER UNIT OR HOUR	TOTAL COST	UNITS OR HOURS	COST PER UNIT OR HOUR	TOTAL COST	UNITS OR HOURS	COST PER UNIT OR HOUR	TOTAL COST	
Labor Skilled											
Unskilled											
Fixed Plant											
Equipment											
Land											
Materials & Supplies											

project will use resources in ways in which they would not have otherwise been used, and thus it will need to assume the additional variable costs. Finally an NFE project may add to the need to expand existing resources. In such a case, the project should be held responsible for a portion of the fixed costs of the resource expansion.

Use Worksheet 3.1, Quantity and Cost of Resources Used by Project, to record unit price, quantity and cost of resources.

C. ADJUST RESOURCE COSTS

There are four general kinds of adjustments that are commonly applied to resource costs:

1) adjustments for inflation;
2) adjustments for depreciation and annualization of capital items;
3) adjustment for the social rate of discount; and
4) adjustments to reflect "social costs."

Not all of these adjustments will be required in every use of your cost data. In the passages that follow, we will describe standard procedures for making such adjustments and, wherever possible, indicate when they are appropriate.

1. Adjust for Inflation

Inflation is a problem in most parts of the world and its effect over the several years of a project can significantly raise the costs of previously budgeted items. In most cases, when your project covers more than one year, you will need to make appropriate adjustments. A convenient way to adjust for inflation is to express all terms in "constant" values (dollars, pesos, rupiah, etc.).* This is done by adjusting all costs (and benefits) according to an appropriate price index so that all prices are expressed in the same units. (Price index values can be obtained from your national planning agency or International Monetary Fund publications). Example 3.8 shows how this is done.

In rare cases, if the project evaluator has good reason to believe that some prices are rising at a significantly faster rate than others, an adjustment can be made for these items over and above the price index calculation. Such adjustments should only be implemented where major, well-defined price distortions have occurred, such as severe weather damage to certain crops. Both the additional adjustment and the reasons for it should be documented and explained.

2. Adjust for Depreciation and Annualize Capital Costs

If a piece of capital equipment or a building is actually purchased early in the life of a project but used over the project's entire duration, it is standard practice to distribute the cost of the capital goods over their lifetime. This is called annualization. But as equipment and buildings are used they gradually begin to wear out or lose value. This gradual decline in value is called depreciation. When dealing with purchased capital items, it is standard practice to account for depreciation and to annualize costs.

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*For the sake of convenience, we will use the phrase "constant dollars" to refer to the inflation adjusted value of a resource.

Example 3.8

A nonformal education program uses telecommunications techniques supplemented by weekly home visits to teach early childhood learning and nutrition principles to mothers in rural communities in several central mountain states. This project began in 1971 with major planning and developmental activities and has been operating from 1972 through 1977. In each year, as shown in lines A.1-3 in the table below, major expenses were incurred for staff, materials and supplies and fixed plant and equipment.

Since inflation has been significant during the period of the project's operation, it is important to separate that portion of the cost which is due to inflation from that portion which is due to increased resource requirements, or quality improvements. This is done by dividing each cost figure by the consumer price index in that year (see B below) and multiplying the resulting figure by 100. In this manner, all costs are expressed in "constant dollars." The constant dollar yearly costs of staff, materials and supplies, and fixed plant and equipment for the project, adjusted by the appropriate price indexes, are listed in lines C.1-3 below.

SELECTED PROJECT COSTS IN CURRENT AND CONSTANT DOLLARS (in $1000's)

	1971	1972	1973	1974	1975	1976	1977
A. Current Dollar Costs							
1. Personnel	45	75	80	92	101	107	115
2. Materials & Supplies	7	22	28	36	43	51	59
3. Fixed Plant & Equip.	84	16	22	25	40	48	54
B. Consumer Price Index	75.2	77.7	82.6	91.6	100.0	105.8	112.4
C. Constant Dollar Costs							
1. Personnel	59.8	96.5	96.9	100.4	101.0	101.1	102.3
2. Materials & Supplies	9.3	28.3	33.9	39.3	43.0	48.2	52.5
3. Fixed Plant & Equip.	111.7	20.6	26.6	27.3	40.0	45.4	48.0

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Table 3.3 VALUES OF THE ANNUALIZATION FACTOR

n	r = 0	r = 5%	r = 7.5%	r = 10%	15%
1	1.000	1.000	1.000	1.000	1.000
2	.500	.538	.557	.576	.615
3	.333	.367	.385	.402	.438
4	.250	.282	.299	.315	.350
5	.200	.231	.247	.264	.298
6	.167	.197	.213	.230	.264
7	.143	.173	.189	.205	.240
8	.125	.155	.171	.187	.223
9	.111	.141	.157	.174	.210
10	.100	.130	.146	.163	.199
11	.091	.120	.137	.154	.191
12	.083	.113	.129	.147	.184
13	.077	.106	.123	.141	.179
14	.071	.101	.118	.136	.175
15	.067	.096	.113	.131	.171
20	.050	.080	.098	.117	.160
25	.040	.071	.090	.110	.155
50	.020	.055	.077	.101	.150

To compute the annualization factor for other discount rates (r), use the formula: $a(r,n) = \left[r(1+r)^n\right]/\left[(1+r)^n-1\right]$.

Adapted from Jamison, Klees and Wells, 1978.

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As the capital item is used, its value depreciates so that at the end of its lifetime its value is equal to zero. Therefore, if the expected lifetime of the item is n years, the value of the equipment or building depreciates (on the average) by an amount equal to 1/n multiplied by the original cost of the equipment.

The annualized cost of capital items requires special treatment since the cost of using this amount of capital in the project includes not only the depreciation of the resource through usage but also the social rate of discount r, the return to this capital in alternative uses. (Refer to Section C for a review of the concept of social rate of discount.) To facilitate the calculation of annualized values taking into account both depreciation and discount rates, you can use tables such as Table 3.3, which shows the annualized cost of a dollar's worth of capital for different expected life-times (n) and different rates of discount (r). If, for example, we wanted to know the annual cost of a $12,000 tractor with an expected service life of 10 years at a social rate of discount r = 5%, we would read down the table to find n = 10. We would then read across that row until we found the column r = 5%. This tells us that each dollar of capital with a ten year life expectancy has an annual cost of .130 using a social rate of discount r = 5%. The annual cost of the $12,000 tractor is $12,000 multiplied by .130 or $1,560.

3. Adjust for the Social Rate of Discount

In all cases where it is conceivable that resources committed to project activities could be used in other profitable ways, a social rate of discount would be applied to project costs to reflect the

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value of the earnings missed (foregone earnings) by not investing in the other alternatives. The value of the foregone earnings depends in part upon the length of time the resources are committed to the project (there will be more earnings foregone by resources committed early in the project than by those committed late) and the discount rates considered appropriate.

Procedures for discounting costs and appropriate discount rate tables have been explained in Section C, under the heading "Adjusting for Time". In order to apply these discounting procedures, we must first consider the problems of selecting a project time horizon and choosing a discount rate.

Selecting a Project Time Horizon. Strictly speaking, the time horizon of your project should have been defined earlier when you identified project objectives and listed required resources. The project time horizon extends from the initial planning period through the years the project is expected to benefit project participants or communities. By specifically considering the project's time horizon at this point, we allow you the opportunity of examining the consequences of varying the project's duration. Such flexibility is useful when the project under examination has various phasing options, a high degree of uncertainty, and/or a very long anticipated duration.

In most cases, you can confine yourself to a single anticipated project period. The effects of alternative time horizons could then be brought into any analyses of projected cost data using a cost function (see Appendix B), or into sensitivity analyses as will be explained later in Step 10.

Choosing a Discount Rate. The choice of an appropriate social rate of discount for project evaluations is a theoretically controversial issue. In general, and especially in the case of small projects, we recommend that you confer with economists in an appropriate Ministry or Government Department about rates which are consistent with central government evaluations. Since any discount rate reflects social judgments, we recommend that you use a number of discount rates to emphasize the sensitivity of the cost adjustments to the chosen values of the discount rate.

Computing Discounted Present Value. Once the time horizon and discount rates are selected, the discounted present values of the project costs may be computed. In most cases computation will simply involve finding the value in the discount table appropriate to your time horizon and discount rate (see Section C), and multiplying the value times your unadjusted costs.

CAUTION: If you have already annualized the costs of capital items according to procedures discussed above, do not compute a discounted present value for them. The social rate of discount for such items was already built into the annualization adjustment.

4. Adjust Prices to Reflect Social Cost

Although market prices are generally considered the best estimate of resource costs, there are certain situations in which the actual prices paid are likely to understate or overstate the costs of using these resources. In a financial analysis of the profitability of an undertaking from an individual or community viewpoint, these biases do not matter since it is the actual cash outlay which is relevant. However, from the national ministry perspective it may be necessary to adjust those "biased" prices so they reflect true social costs. Economists often refer to such adjusted or "true" prices as "shadow" prices.

Given the many practical difficulties in determining the proper values of "shadow" prices, it is recommended that such price adjustments be considered only in a few areas where clearcut distortions have occurred. These most commonly have to do with taxes and subsidies on goods and services, wages in an economy with serious unemployment, and the costs of foreign exchange. National planning agencies will often be able to provide information regarding appropriate adjustments involving taxes, subsidies and foreign exchange. Details and examples concerning the calculation and use of shadow prices are found in Appendix A.

After you have decided which adjustments to make to your cost values, it would be a good idea to summarize all of your adjustments on a single worksheet. Worksheet 3.2 has been designed for this purpose. In using Worksheet 3.2, first enter the unadjusted value of each cost item (resource). In the next column enter the shadow price adjusted value if appropriate. Next enter the value after adjustment for inflation, indicating the consumer price index used. Finally, enter the discounted present value of the resource and indicate the discount rate. The adjustments on the worksheet are cumulative as you move across the page, but of course, you may not need to do them all. Notice that the year is left blank. You should make adjustments for each year of the project (use more than one worksheet) and then total the values at the end of the last worksheet.

Use Worksheet 3.2, Adjusted Values of Project Costs, to summarize the adjustments made to resource values for each year of the project and then total the values over the entire project.

SCOPE Worksheet 3.2

Project Name: ____________

ADJUSTED VALUES OF PROJECT COSTS

Date: ____________

RESOURCE	VALUE OF COSTS							
	YEAR ____				TOTAL			
	UNADJUSTED VALUE	SHADOW PRICE ADJUSTMENT (OPTIONAL)	INFLATION ADJUSTMENT CPI= ___	DISCOUNTED PRESENT VALUE r = ___	UNADJUSTED VALUE	SHADOW PRICE ADJUSTMENT (OPTIONAL)	INFLATION ADJUSTMENT	DISCOUNTED PRESENT VALUE r = ___
Labor Skilled								
Unskilled								
Fixed Plant								
Equipment								
Land								
Materials & Supplies								

CHECKLIST OF SUBSTEPS AND TASKS FOR DETERMINING AND ADJUSTING RESOURCE COSTS

(Step 3)

SUBSTEP	TASK	COMPLETION DATE
A. Determine Resource Unit Prices	A.1 Determine individual unit costs for each resource category A.2 Multiply the unit price times resource quantity to obtain unadjusted costs	
B. Figure the Cost of Shared Resources	B.1 Answer questions about use of shared resources B.2 Calculate the portion of shared cost assigned to NFE project	
C. Adjust Resource Cost	C.1 Make appropriate adjustments for inflation, depreciation, discount rate and shadow prices C.2 Summarize the adjusted values for each year and then total them	

SECTION D

STEP 4

SUMMARIZE AND ANALYZE PROJECT COSTS

Analyzing project costs requires that you consider not only the nature of the project but also the questions which the evaluation is to answer. The most basic evaluation question for NFE projects is: Was this a worthwhile (profitable) investment? Answering this question requires that total project costs be compared to total project outcomes.

The total cost figure represents the sum of the costs of all resources used by the project. You have already listed your project resources on Worksheet 2.1, assigned them costs on Worksheet 3.1 and made cost adjustments on Worksheet 3.2. In Steps 5, 6, and 7 you will record all of your project outcomes. In Step 8 you will be guided in assigning monetary values to outcomes where appropriate and possible. Finally, in Step 9 you will be shown ways of systematically relating total project costs to total project outcomes.

The present step concentrates on two other approaches to using project costs in addressing evaluation questions. They are:

A. Using cost statistics derived from total costs to answer certain kinds of questions, without reference to project outcomes;

B. Using portions of total costs, either by themselves or in conjunction with portions of total benefits, to answer other kinds of evaluation questions.

A. USING COST STATISTICS DERIVED FROM TOTAL COSTS

While it is desirable to consider project costs only in relation to measured outcomes, sometimes this is not possible. This may be because

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meaningful outcome data has not been collected or because it is not available in time for meeting certain deadlines. In such conditions, it is still possible to put your cost data to work providing answers to evaluation questions.

Typical questions which can be answered using a variation on total costs are:

(1) How much does it cost to offer the NFE program to a typical participant?

The cost statistic which addresses this question is the average cost per participant. Given total project cost, this statistic is calculated as follows:

$$\boxed{\text{Average Cost per participant} = \frac{\text{Total Project Cost}}{\text{Total Number of Participants}}}$$

The answer to the above question can help provide answers to other related questions. For example, policy-makers may want to compare costs of an NFE project to costs of a parallel program within the formal educational system. Assuming that the outcomes of the two progams are basically equivalent, a comparison of average per participant costs would give a rough indication of the relative efficiency of the alternative "delivery systems" (NFE and formal).

Even when data on the formal alternative are unavailable, an estimate of the average cost per participant can be useful in itself. For example, multiplying this estimate by the total number of possible participants in a province would provide a very rough estimate of the cost of wide scale implementation. Such a figure can give some indication of how "reasonable" the costs of the NFE program are. In addition, different options within an NFE project can be compared to one another on the basis of their average per participant costs.

Another kind of question is:

(2) How much does it cost to have a typical participant complete the NFE program?

This question requires a slightly different statistic from that above, namely, average cost per completer. It is calculated just as the above, except you divide total costs by the number of project completers, not merely project participants.

When there are high drop-out rates in a project, a simple average cost figure may give a distorted indication of the relative efficiency of a program. For example, it is possible that lower average participant costs are associated with higher drop-out rates. Sometimes, it is useful to also compare programs on the basis of the cost per successful completer.

It is not always obvious, however, what a "successful" completer is without measuring outcomes. In cases where there is an "equivalency certificate" that parallels the formal system, comparisons may be possible if there is reason to believe that the two programs are very similar. Sometimes there are national exams, or there is competition for places in institutions of higher education or apprenticeship programs.

When there is a clear-cut indication of success, cost per completer may make more sense than simple costs per participant. There is a grave danger, however, in relying on project managers' reports of completion without some external check; it is not uncommon to find all enrollees reported as completers even when some individuals never attended a project meeting.

There are other kinds of questions which can be addressed using variations of the above. For example, one may want to assess the average cost per instructional hour or the average costs per participant per year. Such assessments would once again involve dividing total cost figures by other factors like hours of instruction, number of participants and number of project years.

Sometimes analysts relate such factors to one another in a systematic way using mathematical equations called cost functions. Although an explanation of the use of such functions is beyond the scope of this manual, Appendix B, which summarizes the Nicaraguan Radio Mathematics Project evaluation, shows how such functions can be used in NFE program evaluations.

In summary, it is clear that some cost statistics can be used by themselves in addressing evaluation questions. Such an approach should be used with caution because, although you can count numbers of participants, completers, and instructional hours, such numbers do not tell us anything about the quality of participation and instruction in a project. It is the quality factors which ultimately determine whether the project is worthwhile or not.

B. USING A PORTION OF TOTAL COSTS TO ADDRESS EVALUATION QUESTIONS

We began this step by stressing the importance of considering the kind of question the evaluation is to answer. Besides the basic question related to overall investment soundness, there are a number of other questions (already mentioned in Step 1) which refer to possible changes in a project, namely:

(1) Should the project be expanded?

(2) Should the project be continued?

(3) Should the design of the project be changed?

In addition, there is another kind of question of interest where project participation is voluntary, which is:

(4) Will people choose to participate in the project?

All of these questions can be addressed, at least in part, by cost data which represent different portions of total project costs. Such cost data can either be used by themselves (as in the cost statistics above) or in combination with appropriate outcome measures. The following describes what portion of total costs are appropriate in addressing which questions, and briefly indicates how the appropriate cost factors might be used.

1. Should the project be expanded?

Often an evaluation must not only assess a project as it is currently operating but must also assess the desirability of expanding (or cutting back) the project. These considerations are particularly important in evaluating demonstration or pilot projects and in assessing projects which include large capital costs for resources like radio or television transmitters.

The basic consideration in addressing questions of changing a project's scale is the concept of fixed and variable costs. Costs which do not change as the project is expanded or cut back are termed fixed costs. Costs which increase or decrease in accordance with the change in project scale are termed variable costs. Since fixed costs are spread over more and more students (or hours of instruction) as a project expands, the average cost per student (or per instructional hour) will fall accordingly. The amount by which average costs are reduced by changing project scale can vary considerably depending upon the portion of total project costs which are fixed. (See Appendix B for a demonstration of how to treat fixed and variable costs in an evaluation.)

If, for example, an NFE television literacy program currently is providing 2 hours of instruction a day to 500 students in 30 villages and the Ministry of Education is considering expanding the project to serve an additional 200 students, the portion of project cost which should be considered in evaluating the expansion are only those for resources which have to be added because of the 200 additional students. These will most likely involve reception site equipment, instructional staff and student supplies. The cost of television programming and transmission will not be included in the assessment of project expansion since they are fixed or incurred regardless of the number of participating students.

Since projects can be expanded (or cut back) along a number of different dimensions, such cost classifications as fixed or variable will change accordingly. If, for example, the educational television project expanded the number of hours of instruction rather than the number of students, then many of the programming and broadcasting costs would no longer be fixed. Instead they would increase with the number of hours of instructional programming to be provided. Hence, the evaluator must specifically state the dimensions along which the project is to be expanded, classify relevant costs as variable or fixed, and then calculate the relevant additional costs from the change in project scale.

Once the evaluator has specified the additional costs associated with project expansion he or she can compare them with the outcomes which are likely to result from such expansion in a cost/benefit or cost effectiveness framework. In addition, there is a cost statistic, which economists commonly use, called marginal cost, which is often appropriate. Marginal cost refers to the cost of producing one more unit of output (in this case a student or instructional hour). A simple "rule of thumb" often used by analysts is to recommend expansion of a project as long as the marginal cost is falling. Such a recommendation would only be made, of course, under the assumption that by expanding there is not a substantial decline in the quality of the program.

Table 4.1, showing figures from an imaginary NFE project, illustrates how marginal costs, average costs, total cost and numbers of participants are interrelated.

Table 4.1

COST RELATIONSHIPS FOR A SAMPLE NFE PROJECT

Number of Participants	Total Cost	Average Cost Per Participant	Marginal Cost
20	$ 600	$30	
40	$1000	$25	$20
60	$1200	$20	$10
80	$1600	$20	$20
100	$2200	$22	$30

2. Should the project be continued?

In addressing this question the relevant costs are only those that will be charged to the project during the period the project is to be continued. Costs which have already been born, although relevant to an assessment of the project's overall investment worth, are not relevant. The previous costs (including set-up and operational costs to the current moment) are often termed "sunk costs" because they cannot be recovered and put to alternative uses.

The specific portion of costs associated with continuing a project can be analyzed in conjunction with the outcomes expected to result from continuation (according to procedures outlined in Step 9). Very often the results of such analyses will be favorable because so many of the important project expenditures are in the past (sunk costs) and so many of project outcomes are in the future.

The above considerations are also relevant when policy-makers are interested in replicating a project. In this case, many project design and set-up costs which were counted as costs in the original project, will not need to be counted in project replications. This is also the case when the original project is a pilot project or demonstration program.

3. Should the design of the project be changed?

NFE projects generally consist of a number of different activities. Changing the design of a project could be viewed as adding or subtracting a particular activity (or activities). In order to decide which activities to add or subtract, decision-makers may need to know the costs and outcomes associated with each activity.

It is often difficult to distribute costs among activities, since resources are often "shared" by different project components. However, one can at least estimate the resources used in each activity. (Remember that in Step 2 we gave an example of listing resources by activity.) Once the resources are listed they can be assigned costs according to the appropriate unit prices and then summed over the life of the project.

Once the costs associated with various activities are independently determined they can be compared with their respective outcomes. If it is not possible to break down outcomes in this manner, average per participant costs can be compared across activities. Alternatively, if the project design includes at least two project options, one with a particular activity and one without it, it is possible to compare the cost/benefit or cost/effectiveness analyses of the two options (see Step 9 for details).

4. Will people choose to participate in the project?

Although this is a very complex question involving, among other things, personal values, motivation, social and political factors and project organization, it is perhaps more than anything else an economic question. In economic terms the question can be rephrased: Are the benefits I receive from the project worth the project's cost to me?

In order to assess the cost aspect of that question it is necessary to value all of the resources an individual will have to provide in order to participate over the full duration of the project (this includes the value of the participant's own time). The possibility already exists for summarizing the costs to individuals, since on Worksheet 2.1 you listed each project resource by source of funding. Using the unit prices listed on Worksheet 3.1 you should be able to calculate the "private" costs of the project to individuals. Dividing the total private costs by the number of participants would give you the private cost per participant.

This cost statistic can be useful to policy makers in assessing whether the program offers individuals reasonable incentives to join. Sometimes it is obvious that "a person would have to be crazy to give up so much to participate in our project." Obviously unworkable projects can be avoided by looking at the costs to participants.

A second use for this information is to provide a rough estimate of whether the costs are within the reach of the typical participant. A project might be very worthwhile, but remain beyond the grasp of the population for whom it was intended.

It can be quite useful to identify different groups of potential participants and calculate the total cost for a typical member of each group. Often, comparison of these cost figures will be a good indicator of who is likely to participate in the project. This information of this particular value to Ministry and donor decision-makers who attach special importance to reaching particular targeted groups of participants.

It should be noted that the same kind of question (Should we participate?) could be asked from the perspective of communities, organizations or donor agencies. In these cases, the costs born by the group in question can be calculated using Worksheets 2.1 and 3.1 and compared with the outcomes that the group is interested in promoting. If it is the total perspective (the societal or government ministry point of view) that is of interest, total costs are, of course, the relevant factor and the analysis can procede according to the remaining steps in this section.

C. Summary

In this step we have described various ways of summarizing costs in order to appropriately address evaluation questions. Some cost factors, standing by themselves, present to policy-makers indications of project success or viability. Other cost factors, appropriately isolated and summarized, can be used in conjunction with appropriate outcome measures to answer specific evaluation questions. As you, the evaluator, become familiar with your cost data, their strengths and limitations, you should be able to determine ways to summarize them so that they are understandable and useful to policy-makers.

CHECKLIST OF SUBSTEPS AND TASKS
FOR SUMMARIZING AND ANALYZING PROJECT COSTS
(STEP 4)

SUBSTEPS	TASKS	COMPLETION DATE
A. Analyze Cost Statistics Derived from Total Costs	A.1 Review evaluation questions. A.2 Decide which can be addressed by which cost statistic. A.3 Calculate the statistic.	
B. Analyze an Appropriate Portion of Total Costs	B.1 Determine which question can be addressed by summarizing a portion of total costs. B.2 Calculate a cost statistic derived from a portion of total costs, or B.3 Summarize the portion of total costs to be used later in analysis with appropriate outcome measure.	

SECTION D

STEP 5

SPECIFY INTENDED PROJECT OUTCOMES: EDUCATIONAL

In Step 1, project goals and objectives were defined and classified into three categories: Learning Objectives, Skill Application Objectives, and Overall Development Goals. Each category was regarded as a part of a chain of events linking project resource inputs to the achievement of ultimate development goals. In this section and the two which follow, we shall examine various methods of measuring how well these goals and objectives are being met as a result of the project under consideration. Step 5 focuses on the specification and measurement of direct learning outcomes; Step 6 is concerned with the application of the knowledge, skills, or attitudes developed; and Step 7 looks at social and economic changes, both intended and unintended, which result from the use of the new skills.

Naturally, no single presentation can tell everything about NFE project assessment. The variety of context, the politics of each situation, the availability of resources must all be considered. There is no single recipe; there is no simple formula. However, there are basic principles of project evaluation applicable to both large and small projects, and there are a variety of proven research methods which can be adapted.

The discussion which follows covers four major activities for stating the intended educational outcomes of an NFE project:

A. Identify planned outcomes and performance indicators.
B. Determine the evaluation design.
C. Select and implement data collection methods.
D. Interpret and analyze the results.

Although these activities are presented in sequential form, the reader should be aware that the documentation of project outcomes is an interactive process. Only after the evaluator reviews possible indicators, designs, data collection techniques, and analysis methods can the best combination for the particular assessment be chosen.

Each activity is relatively simple, although each must be well planned and done carefully. The discussion which follows is directed mainly at the most common evaluation situations in developing countries -- those in which research support (in terms of both staff and funds) is extremely limited.

A. IDENTIFY PLANNED OUTCOMES AND PERFORMANCE INDICATORS

We assume that any educational project involves the transfer of skills, attitudes, or information to participants. Project assessment requires estimating, to some extent, this transfer in behaviorally measurable terms. Estimates of how many people were served by the program or how many learning posts in how many villages were established provide useful information. However, such information, in and of itself, is inadequate for project evaluation. The more relevant and difficult questions are "How well did the students learn?" and "To what extent were attitudes changed?" These outcomes are the crucial kinds of questions to ask if we want to assess and interpret project learning. As we mentioned earlier, educational outcomes need not be measured precisely to evaluate a project. In many cases, outcomes which fall into the realm of socioeconomic development (what we call skill application or development outcomes) could be measured directly, or through appropriate proxies, without the intervening educational outcomes ever being directly measured themselves.

The targeted educational outcomes should be conceived and defined in terms that are compatible with behavioral measurement. For example, if the aim of the project is to improve the participant's self-image, that concept, "self-image," must be defined so that progress achieved can be clearly reflected in the participant's performance. Such a procedure vastly increases the likelihood that the specific project and the targeted development outcomes will agree.

You should now review the learning objectives which you listed for your NFE project on Worksheet 1.1. If the project designers have previously decided the pace of change, the minimum performance level, and precise target audience to be affected by the learning exercise, this should be stated on your worksheet. However, in those cases in which project objectives are not clear or not directly measurable, it is necessary to select performance indicators which will signal if project participants learned the stated knowledge and skills.

The best way to do this is to review all of the factors which make up the desired behavioral change; and then to select the most important. Such indicators should be stated in terms appropriate for the social context in which the project functions and in terms for objective evaluation.

The task of providing learning objectives and achievement indicators for NFE projects is often easier than providing those for the formal education system. NFE projects are most often designed as components of larger development projects and are expected to produce specific skills and knowledge considered important to local economic well-being. Examples of achievement indicators for common types of NFE projects are presented in Table 5.1.

Table 5.1

EXAMPLES OF EDUCATIONAL OUTCOMES AND PERFORMANCE INDICATORS

Project Type	Educational Outcome	Performance Indicator
Agricultural Extension	increase in knowledge of agricultural production process	-can relate increases in yield to proper production processes
	increase in ability to use mechanized farm tools and machinery	-can plow certain size plot within given period of time -knows how to fix or replace tools and machinery
Off-Farm Employment	increase in occupational and technical knowledge	-can explain duties involved in job -can define technical terms -can use professional tools in work sample test -can perform task at a given level of competence
Family Life, Health, Nutrition	increase in business management skills	-can pass a quiz on investment alternatives -can organize a simulated work schedule
	increase in knowledge of health and nutrition	-can list health care facilities -can list components of well-balanced meals -can identify common diseases by symptoms
	increase in ability to manage household funds	-can explain simple investment principles -can design a usable household budget
Literacy	increase in reading and writing ability	-can read a local newspaper -can communicate by letter
	increase in ability to define development alternatives	-can list government and private social services -can use problem solving techniques in class -can explain the local political process

When NFE projects are designed as alternatives to formal academic or vocational education, measurement of acquired knowledge and skills should not differ substantially from those used for the formal school system. As Kiros, Mushkin, and Billings (1975:99) point out,

> ...it is essential that measurement criteria be adopted that permit evaluation by the more formal education system criteria pertaining to knowledge and skills acquired nonformally. The conversion of experience into tested competence will allow cross-overs from one system to another.

It is important that the selected indicators for NFE projects be plausible and reflect a reasonable level of competence that can and should be expected from project participants. The final selection of performance indicators depends on the type of evaluation design selected, the nature of the data collection techniques available, and considerations related to evaluation costs and time constraints.

B. DETERMINE THE EVALUATION DESIGN

Once you have clearly defined expected educational outcomes and the indicators of their achievement, the next step is to select a strategy for assessing the impact of the project upon the learning of the participants.

> Good design enables one to compare with confidence the performance of students on such dimensions as past and future, program groups and nonprogram groups, Treatment A group and Treatment B group. It lets us know what change has occurred, what gains or losses have been, which of several procedures is preferable, and whether sought-after objectives have been reached (California State Department of Education, Program Evaluator's Guide, 1977:Ci).

Ideally, the evaluation design should be selected prior to or at the start of the project. This assures that benchmark information can be collected. Such information indicates the status of the participants' knowledge, skills, or attitudes at the start of the project.

Basic Evaluation Designs

There are several basic designs to consider for the evaluation of educational outcomes. The criteria for selection depends upon the information needed for the evaluation and the standard against which you wish to compare project outcomes.

The most simple design matches learning objectives with the participant's mastery of particular skills or a specified body of knowledge at the end of the project.

DESIGN A -- Has the level of participant's performance at the end of the project fulfilled the learning objective?

learning objective → project → performance level

This design should be considered if you cannot or do not need to compare the effectiveness of different projects or procedures in producing similar skills. For example, a project may be designed to train young people in textile manufacturing for local employment in rural areas. The participants would have no prior artisan training and there may be no alternative project or local process for teaching similar skills. In this case, it would be necessary only to compare performance level at the end of the project with the specified goal at which the project was aimed.

If you wish to know how much the group of participants improved over the life of the project, a pretest/post-test evaluation design should be selected.

DESIGN B -- What gains did participants make from the start of the project to the end?

pretest of participant ability ⟶ project ⟶ posttest

This design compares the participants' abilities at the start of the project with their level at the end of the project. In this way, the analyst is able to measure the amount of change which took place over the course of the project. Thus, in a literacy project if the aim were to increase reading scores by a certain number of points at the end of the project, this design might be selected.

Whenever the results of successive measurements are to be used to document change, the measurements must be comparable. The analyst must make certain that both the instruments and the data collection schedule and procedures are as alike as possible. Try to use parallel tests for both pretreatment and post-treatment measurement. Also, attempt to duplicate the conditions under which pretests and post-tests are given. For example, measurements taken just before an important holiday may not be comparable to measurements taken during a more normal period, and interviews in the home may not be comparable to interviews at the training facility.

Designs A and B allow us to discover whether the type of changes sought during the NFE project have taken place. However, they are inadequate for assisting us to link these changes to the development project in question. If you want to attribute participant gains to the project you are assessing, you should choose a design which compares the status of two groups, one of which has participated in the NFE project and one which has not. Using a design such as Design C below, you can estimate the gains attributable to the project as follows:

Posttest minus pretest scores for project group	less	Posttest minus pretest scores for comparison group

DESIGN C -- How do project participants compare in achievement with a similar nonproject group?

pretest of project group → project → posttest

pretest of comparison group → posttest

The use of separate comparison groups is the most typical strategy for evaluating outcomes. In using a comparison design, the two populations being observed must be as similar as possible. However, the comparison group is not exposed to the NFE project.

Ideally, a comparison group design should include the random placement of samples of the same population in both project and nonproject groups, so that the influence of such outside variables as motivation to participate or family income are minimized. This may be accomplished in situations in which an NFE procedure is introduced into a formal school setting and it is possible to randomly assign students to treatment and nontreatment classes. Also, such a grouping can take place if participants in an extension campaign are selected on the basis of a random sample conducted in their village or district (Appendix C includes a discussion of sampling techniques).

If project participants, however, were self-selected or were chosen prior to the establishment of an evaluation design, it is most important to create groups on the basis of similar group characteristics. Such characteristics might include age, sex, prior training, level of education, ethnic origin, family income, secondary occupation, land size, and so on. Otherwise, differences in performance may be attributed more to differences among populations than to the impact of the project in question.

Good benchmark data on both project and nonproject groups facilitate the measurement of educational outcomes and their link with the NFE project. In cases where pretest data cannot be collected especially on nonproject groups, post-tests alone might be enough. However, it is necessary that the groups be well matched in the important variables which may affect educational outcomes.

It should also be mentioned that in countries using standardized achievement tests, the scores of students in NFE projects which offer academic training can be compared with broader norm reference groups. However, it is important that the student group in the NFE project be comparable to that in the broader population and that the test be given under similar environmental conditions (Kiros, Mushkin and Billings, 1975:10-25).

The designs we have discussed provide information necessary for assessing the overall intended impact of a treatment or project. But they are often not sufficient for developing or revising specific parts of the project. If you wish to know which parts of the NFE project contributed most to the learning outcomes observed, you might consider a design in which all relevant learning factors are kept constant except those under consideration. Such factors might include teacher experience, class size, learning techniques, instructional materials, and so on. For example, if you wish to evaluate the effect of two types of agricultural demonstration techniques, with and without follow-up consultations, your design might look like this:

	Demonstration Technique	
	Type 1	Type 2
Follow-up	A	C
No Follow-up	B	D

Ideally, the same extension officers should be used for both demonstrations or officers as similar in their training, experience, and attitudes as possible. The social and environmental setting for the demonstrations should be reasonably alike, and the participants should be assigned to the different treatments on a random basis. The California State Department of Education, Project Evaluator's Guide (1977:C7) contains other types of designs.

In planning your strategy to evaluate intended educational outcomes, here are a few important points to remember:

(1) Develop an evaluation design which includes all learning objectives.

(2) Be sure the pretest and post-test are comparable.

(3) If you use a comparison design, be sure that the project group and nonproject group are as alike as possible.

(4) Subtract the gains obtained by the comparison group from those obtained by the project participant to estimate the changes attributable to the project.

(5) Check at several points during the project to see if it is being implemented as planned.

Further considerations in selecting an evaluation design are discussed in Step 6 and Step 7.

C. SELECT AND IMPLEMENT DATA COLLECTION TECHNIQUES

The type of assessment instruments or data collection techniques to be used in a particular project evaluation depends upon the nature of the information required, the sources of data to be used, and the amount of financial and staff resources available. As a general rule, assessment instruments should be as simple as possible and appropriate to the particular cultural setting in which they are to be used. The amount of data collected should be limited to only that needed for project planning and management decision. As project analyst, you should find out what type of project data have been or are being collected, and what type of assessment instruments are available. Try to build upon data gathering techniques which currently exist or, if necessary, construct new assessment instruments which do not require large financial outlays or large inputs of staff time.

Table 5.2 (page 1)

SOME METHODS OF ASSESSING EDUCATIONAL OUTCOMES

	ASSESSMENT MODE	DEFINITION/ DESCRIPTION	ILLUSTRATION/ EXAMPLES	ADVANTAGES -- WHEN USED	PROBLEMS	CONSIDERATIONS
I. PERFORMANCE TESTS	WORK SAMPLE	Realistic representation of the task Requires the accomplishment of a specific task in a controlled setting Attempts to reproduce important parts of the actual job	In order to measure Hamid's carpentry skills, he is instructed to construct specified joints using specially provided materials	Especially appropriate in the case of competencies that focus on what one is able to do with knowledge rather than upon knowledge itself or products produced as a result of performance Minimizes language facility Used when difficult or expensive to measure in natural setting Evaluates ability to perform an action, process, or task	How representative is it of the real situation and how comprehensive Both necessary for valid results Bias possible on part of observer; observer might not be able to note all relevant behavior; good to have two or three observers	Be certain the test represents what happens in a performance in a natural situation Should be representative sample of actual performance on the job Should be judged by more than one expert to obtain good reliability
	STRUCTURED OBSERVATION (UNOBTRUSIVE) Mode: Live/ Audiovisual	The candidate is engaged in some realistic task Assessor observes behavior in a structured setting	In order to measure Jose's planting competency, two extension officers accompany him at various times as he is working on the demonstration plot	When other means are not available, appropriate for measuring ability to apply knowledge	High cost factor At times, difficult to control variables	Record behavior, categorize according to criteria predetermined, use rating scale or checklist, make judgment

Adapted from Knapp, J. and Sharon, A. (1975)

Table 5.2 (page 2)

	ASSESSMENT MODE	DEFINITION/ DESCRIPTION	ILLUSTRATION/ EXAMPLES	ADVANTAGES -- WHEN USED	PROBLEMS	CONSIDERATIONS
II. SIMULATIONS	ROLE PLAYING	Person-to-person behavior with assigned role and task	Simulated interview; e.g., participate in interview with customer who wishes to buy on credit	For interpersonal job-related behavior; judge ability to communicate, to analyze, to prioritize, to decide	Little research to date on measurement problems Some factors may interfere with reliability and validity Difficult to determine stability	Designed to provide specific controls over the situation and deliberately omits some aspects of the operation which are variable or unpredictable
	CASE STUDY WRITING	Involves a fairly complete and realistic statement of some problem; writes analysis in specified time with alternative solutions and recommendations for action	Person in vocational training project analyzes several employment situations	Ability to analyze and solve complex problems, especially in human service area and clinical problem solving		

Table 5.2 (page 3)

ASSESSMENT MODE			DEFINITION/ DESCRIPTION	ILLUSTRATION/ EXAMPLES	ADVANTAGES -- WHEN USED	PROBLEMS	CONSIDERATIONS
III WRITTEN RESPONSES	CONTROLLED RESPONSE	ESSAY EXAMS	Instruments characterized by questions or tasks to which student responds by organizing and writing an answer	Problems in a health area	Presenting knowledge in a subject area in writing; expressing thoughts effectively, coherently in a sustained manner in writing	Measurement error in ratings; different raters assigned different judgments to same paper	Rate answer according to degree of quality or merit which can be recognized
		OBJECTIVE EXAMS, OR CLOSED-ENDED QUESTIONNAIRES	Consists of questions in which form and content of responses are limited. Objective tests contain guided response items and are objective in method of scoring	True/false Sentence completion Matching items Multiple-choice exams	To measure learning outcome directly related to areas of knowledge Most appropriate for measuring possession of set body of subject matter information Can test many inexpensively	Difficulty of constructing objective tests to measure more than memory	Be certain exam covers the subject matter you want measured and is directly related to it Must be appropriate to language, content level, and culture of examinee
	FREE RESPONSE	OPEN-ENDED QUESTIONNAIRES, REPORTS DIARIES LOGS JOURNALS PORTFOLIOS	Modes of recording experience; can provide a sample of student's cognitive and affective processes	Travel diary, field experience log Ongoing, experiential settings: record of learning activities; description of past learning	Use for analysis, synthesis knowledge of a situation, evaluation	Is it a direct sample of learning, or indirect, from which the expert must deduce cognitive and affective learning? How does one verify assertions?	Avoid crediting verbal facility in place of other competences Need to apply content analysis Subject can express thoughts and feelings; reflection on experience and self-analysis

Table 5.2 (page 4)

	ASSESSMENT MODE	DEFINITION/ DESCRIPTION	ILLUSTRATION/ EXAMPLES	ADVANTAGES -- WHEN USED	PROBLEMS	CONSIDERATIONS
IV. INTERVIEWS	ORAL EXAM	Direct assessment of certain knowledge and skills Questions planned in advance Pre-set standards	Grace's attitude toward and competence in nutritional planning is assessed Questioned concerning knowledge acquired, views on what she studied, judgment in applying principles	In situations where candidate is the best source of information about the competence; level of reading ability of examinee is low; supplements other measurement techniques to insure all facets treated	Time-consuming and costly (compared to group paper-and pencil exam)	Interviewer will have a list of questions relating to competence to be measured; assessor will take notes
Structured	ONE-TO-ONE DIALOGUE OR ORAL QUESTIONNAIRE	Face-to-face interpersonal situation in which the interviewer asks questions designed to obtain answers which will lead to an evaluation of learning outcomes		Adaptable to individuals For measurement of complex concepts; comparison and contrast Relatively objective measurement of knowledge	Structured are more reliable than unstructured Problem of "loaded" questions and interviewer leading the respondent	Usually highly structured, has goal or purpose, and roles of participants are clearly understood Need to stimulate full response
Unstructured	LEADERLESS GROUP DISCUSSION	3-6 participants Roles either assigned or not; given cases or problems Resolve and submit a resolution	Several participants have common experience on basis of which learning is to be assessed	Ability to work in a group situation; leadership skills; can provide direct learning and feedback; interpersonal interaction	Amount of structure that can be imposed is limited and therefore validity and reliability limited. Costly	Presence of several assessors is needed

1. Types of Assessment Techniques

Table 5.2 provides a list of some common assessment techniques for educational outcomes, along with examples, advantages and disadvantages. The major criteria for selecting an assessment instrument is its ability to give the information needed for the evaluation. If, for example, you wish to determine what an individual knows or what information he may have learned, the following instruments might be considered:

paper and pencil tests
oral exams or interviews
group discussions

If you need to measure the level of new skills acquired, you might find the following instruments particularly useful:

work sample tests
simulation techniques
observational reporting

For assessing personality traits (e.g., resourcefulness, adaptability, leadership) or attitudes toward self-reliance, cooperative marketing or local political participation, you might consider:

free written response techniques
interviews
closed-ended questionnaires
observational reporting
simulation techniques

2. Using Multiple Measures

Ideally, the technique you select for assessing an educational outcome should have the following characteristics:

validity -- it tests what it is meant to test

clear questions and instructions

appropriateness to examinee and situation

reliability -- it yields consistent results when given to similar groups at different times

simplicity in administration and analysis

However, in attempting to assess an important educational outcome, especially an attitude or personality trait, it is usually difficult to find or construct a totally reliable or comprehensive measure. Therefore, a number of more indirect measures of that outcome should be used. Each measure may have its own source of bias. However, if the evaluation showed that regardless of the measure used the results remain about the same, then the assessment can be assumed to be reliable.

When primary outcomes are being considered, multiple measures and multiple sources of information should be used in any case. Prepared written tests should be accompanied by interviews or the instructor's day-to-day assessment; and attitudinal questionnaires should be cross-checked against observational reports. Diaries, logs, free-response essays, etc., by participants should be matched with reports by others associated with the project. Even the information you receive from participants regarding their socioeconomic background and previous learning experience should be cross-checked with peers, kin, instructors, and other knowledgeable persons. This information, useful for later understanding of the results of your evaluation, should be as accurate as possible. Other considerations in selecting data collection techniques are discussed in Step 6.

3. Constructing Assessment Instruments

Many educational outcomes in NFE projects require the construction of tailor-made tests and questionnaires. If you have not had experience in constructing testing instruments, you should seek assistance from local social scientists, technical experts in the project's subject area, or others with experience in measurement of outcomes. In general, the steps outlined below which are recommended in the California State Department of Education, Project Evaluator's Guide (1977, p. D78) should be followed:

1. Develop a plan that specifies the information wanted.
2. Prepare a draft.
3. Have several persons review the draft for ambiguities, omissions, and unnecessary pieces of information.
4. Develop directions for administration.
5. Develop a scoring key.
6. Field test the instrument by administering it to persons similar to the intended subjects.
7. Revise the instrument as necessary.

The use of questionnaires, interview guides, observation reporting and so on, is discussed further in Step 6.

In collecting educational outcome data, whether from performance test simulations, written responses, or interviews, be sure that assessment conditions are as objective as possible. In addition, minimize the presence of outside evaluators and the use of disruptive evaluation procedures. By doing so, you are more likely to limit the temporary (but misleading) behavioral changes which usually occur when the subjects of an evaluation

SCOPE Worksheet 5.1

ASSESSMENT STRATEGY FOR INTENDED EDUCATIONAL OUTCOMES

Project Name: ____________________ Date: ____________________

INDICATOR	DESIGN	DATA COLLECTION TECHNIQUE	TO WHOM	BY WHOM	WHEN

realize they are being observed. Be sure data collection personnel are adequately trained and that work responsibilities are clearly assigned.

Use Worksheet 5.1, Assessment Strategy for Intended Educational Outcomes, to record your evaluation strategy for the educational outcomes associated with your NFE project. Be sure you have planned an evaluation design, identified indicators, selected measurement instruments and assigned staff responsibilities to cover all of the educational outcomes you have to assess.

D. INTERPRET AND ANALYZE THE RESULTS

After the data have been collected, the next step is to organize and summarize the information so that it is easily understood. The more structured the assessment instrument used (e.g., objective tests or precoded questionnaires), the easier is the scoring analysis. For open-ended questionnaires, interview schedules, observational reports, essays, or simulations, it is first necessary to prepare the data in a meaningful and efficient way before applying statistical analysis techniques. Detailed information on the process of editing, classifying, coding, tabulating and summarizing data is presented in Appendix D. Information from each assessment instrument requires the application of statistical analysis. If you feel uncomfortable in the employment of statistical techniques, concentrate on preparing the data and then seek outside assistance for statistical summarization.

1. Interpreting the Results

Usually, it is insufficient for the evaluator simply to summarize the data, apply tests of significance where necessary, and report the results. Most often, the analyst is also responsible for interpreting the nature of the findings. Statistical significance helps us decide if an educational difference is real (it did not happen by chance), but it does not tell us whether the difference indicates how well the project worked. Let us consider, therefore, some of the factors we should take into account when interpreting how well we measured the project's educational outcomes:

Some Factors in Interpreting the Results

Factor	Question to be Answered
1. representativeness	Do you have data which represent the performance of the total target group?
2. length of impact	Do you have the results of a follow-up study to show it is having a continuing positive impact?
3. range of impact	Does the project have educational impact in areas other than the project's intended objectives?
4. strengths and weaknesses of instruments used	Were the instruments valid, reliable, and appropriate? Did the instruments allow people to directly or indirectly demonstrate their skills, knowledge, or attitudes?
5. strengths and weaknesses of the design used	Can the outcomes be attributed to project factors alone? Was the comparison group equivalent to the project group and were they exposed, in any way, to the project?

In the assessment of NFE projects, it is often not possible to select participants by random sampling, to assess long-term outcomes, to investigate broader educational objectives, to use highly reliable measures, or to have an ideal design. The funds may not be available, decisions cannot wait long enough, experts may not be available to provide assistance, the evaluation may have been an afterthought, and you may not wish to invest your own time. Therefore, you must report your results with due caution and indicate both their limitations and strengths.

2. Analyzing the Results

As evaluator, you may also be asked to analyze the evidence of achievement and explain why the results occurred as they did. Such an explanation would be expected particularly if the project results were poor. An analysis of project results should take into account not only the participants' achievements, but also other characteristics of the participants and their environment. This is essentially a call for a systems approach to project evaluation -- that is, dealing with the interrelatedness of all factors (social, environmental, and educational) which may affect performance.

In the assessment of educational outcomes, there are two major areas to investigate for factors which may affect the proper functioning of the project: the structure and organization of the project itself, and the characteristics of the participants.

Some Factors Affecting Education Outcomes

Project Characteristic

- instructor training
- instructor knowledge/attitudes
- content appropriateness
- feasible education approach
- adequacy of physical resources
- instructional group size
- calendar conflicts
- ability grouping
- administrative coordination

Participant Characteristic

- age
- sex
- previous education level
- motivation/attitudes
- occupation(s)
- family size/household size
- income/family income
- ethnicity
- parents' education
- marital status
- size and nature of land holding/expected holding

Not all of these factors may be important to the type of project you are evaluating. You can decide which factors require special attention by referring to Worksheet 1.3, Review of Project Assumptions. Under learning objectives, you listed what you believed to be underlying assumptions in the project design, and you commented upon factors which you suspected might affect the realization of those assumptions. This is an excellent place to begin to try to discover the cause of a poor project result or to explain why the project was successful. It is only by understanding the processes which produce the effects, that you will be able to develop a rational basis for suggesting ways of increasing the effectiveness of this and future projects.

Use Worksheet 5.2, Analysis and Interpretation of Intended Educational Outcomes, to describe the results, specify the limitations of the findings, and identify factors affecting the outcomes.

SCOPE Worksheet 5.2 (page 1)

ANALYSIS AND INTERPRETATION OF INTENDED EDUCATIONAL OUTCOMES

Project Name: ______________________________ Date: ____________________

INTENDED OUTCOME (abbreviate)	INSTRUMENT (abbreviate)	RESULTS (Use separate sheet as necessary)	LIMITATIONS	EXPLANATORY FACTORS (Use separate sheet as necessary)
EO 1.				
EO 2.				

SCOPE Worksheet 5.2 (page 2)

ANALYSIS AND INTERPRETATION OF INTENDED EDUCATIONAL OUTCOMES

Project Name: ______________________ Date: ______________

INTENDED OUTCOME (abbreviate)	INSTRUMENT (abbreviate)	RESULTS (Use separate sheet as necessary)	LIMITATIONS	EXPLANATORY FACTORS (Use separate sheet as necessary)
EO 3.				
EO 4.				

CHECKLIST OF SUBSTEPS AND TASKS FOR SPECIFYING INTENDED EDUCATIONAL OUTCOMES (STEP 5)

SUBSTEP	TASK		COMPLETION DATE
A. Identify planned outcomes and performance indicators	A.1	Review learning objectives stated on Worksheet 1.1	
	A.2	Where objectives are unclear or not directly measurable, select proxies which characterize components of desired change	
B. Determine the evaluation design	B.1	Decide which data elements are needed for the evaluation	
	B.2	Select a standard against which to compare each educational outcome	
C. Select and implement data collection techniques	C.1	Identify what type of project data are being or have been collected and what assessment instruments are locally available	
	C.2	Choose reliable and comprehensive instruments which are suited to the respondents, social setting, and management structure at hand	
	C.3	Select multiple measures for difficult-to-measure or high priority outcomes	
	C.4	Review new assessment instruments with knowledgeable local persons, field test, and revise as necessary	
	C.5	Train personnel and assign work responsibilities	
D. Analyze and interpret the results	D.1	Summarize data and, if necessary, apply tests of statistical significance	
	D.2	Determine measurement limitations	
	D.3	Explain why the results occurred as they did	

SECTION D

STEP 6

SPECIFY INTENDED PROJECT OUTCOMES: SKILL APPLICATION

Since the primary goal of most NFE projects is to increase the political and economic participation of low income populations, project objectives tend to be described broadly. Thomas La Belle (1976:345) states that creating opportunities to transfer and apply what is learned is equally important as increasing cognitive abilities.

> Although it may be "good" to be literate or to be critical of one's reality, and both may have long term benefits, such efforts in the short term are as likely to lead to frustration as they are to more decision-making power or increased socio-economic status. Without inputs like jobs, credit and organization in a supportive social and bio-physical environment, new behaviors learned in nonformal programs of education have little impact on participants and they become mere tokens in the presence of an individual's real life conditions.

Skill application outcomes refer to practices which are adopted as a result of gaining new knowledge, skills, or attitudes. Skill application outcomes are the next link in the chain of events in which educational outcomes from the project are put to use to achieve ultimate development goals. The key test of project effectiveness at this level is whether project participants have put into practice what they have learned.

When analyzing educational projects, it is important to bear in mind that the realization of learning objectives does not necessarily assure that participants will make good use of their educational experience in their subsequent careers or day-to-day living. For example, a participant in a health education project may score high on a test of knowledge and even indicate a positive attitude toward the use of government clinics for family health problems. Yet, when the time comes for actually using the clinic, the participant may fall back on more customary forms of village health practices. Sometimes very broad and unproved claims have been put forth in support of certain NFE approaches. It is not unreasonable, therefore, that the analyst ask which social benefits are thought to be linked to a particular project, and then determine if the assumed relationship is at all possible.

The sequence of activities for specifying desired skill application outcomes is the same as that followed in Step 5 for specifying educational outcomes. Also, as in Step 5, only basic evaluation principles and methods will be discussed, and it will be left to the analyst to adapt these to the particular NFE project and social setting under consideration. Where suggested procedures duplicate those presented in Step 5, the reader will be referred to the previous discussion.

A. IDENTIFY PLANNED OUTCOMES AND PERFORMANCE INDICATORS

Intended skill application outcomes must be defined so that objective measures can be applied to verify their realization. As recommended in Step 5, first review the project objectives which you listed on Worksheet 1.1. The skill application outcomes expected as a result of the project may have already been described in measurable terms. Such terms should include the target group or area to be affected, the pace of change, the minimum level of performance, or the amount of change expected.

If, however, they are still vague, there is a need to separate them into a set of behavioral conditions which can show the results of the project. A simple way to accomplish this is to list the behavioral factors which constitute the skill application process. As an example, let us use a farmer in an extension project who has learned about a new technology for maize production. The application of the technology could be broken down into parts: early planting, use of hybrid seed and chemical fertilizer, row spacing, weed control, and timely harvesting. Each of these activities could be used as an indicator of a skill application objective. The analyst could also choose as indicators, a set of implied behaviors which are associated with the new production process: increase in financial outlay, use of more labor, purchase of seed and fertilizer, change in interplanting practice. In addition, if information concerning these activities is difficult to obtain or believed unreliable, the analyst could select such indicators as sales records, farmer credit issued, or requests for technical assistance from the agricultural extension staff. Further examples of skill application indicators are presented in Table 6.1.

B. DETERMINE THE EVALUATION DESIGN

Before the start of the project, an evaluation design should be selected which includes each skill application objective. Various simple types of evaluation designs are described in Step 5. The most common designs for specifying the application and transfer of new skills, knowledge, and attitudes are the single group premeasurement-postmeasurement design, and the separate comparison group design (Design B and Design C described in Step 5).

A premeasurement-postmeasurement design allows us to compare the habits or practices of the target group before the project with those after the project. Sometimes, however, analysts using such a design fail

Table 6.1

EXAMPLES OF SKILL APPLICATION OUTCOMES AND PERFORMANCE INDICATORS

Project Type	Skill Application Outcome	Performance Indicator
Agricultural Extension	follows new production process	-plants crop prior to onset of rains -purchases chemical fertilizer -employs more labor
	practices cooperative farming	-purchases seed and fertilizer jointly with other farmers -markets crops jointly -increases amount of group work during land preparation
Off-farm Employment	uses new business management skills	-works longer hours -keeps accurate records -reinvests over half of the profits in business
	applies new occupational skill and knowledge	-change in work output -obtains wage employment at viable income -length of job-hunting period lessens
Family Life, Health, Nutrition	follows recommended health practices	-uses clinic regularly -lower incidence of disease -builds latrine
	uses knowledge of nutrition	-increases consumption of eggs and poultry -expands production of vegetables for home consumption
	applies new attitudes toward civic participation	-joins local organizations -takes leadership role in organizations
Literacy	reads regularly	-retains or improves test scores at one year follow-up -continues schooling
	undertakes socio-political action as a result of functional literacy	-participants coalesce into groups for social action -increase in village projects/repairs initiated locally

to properly assess skill application outcomes because they examine only the participant's immediate behavior at the end of the project. For example, an analyst might find that a farmer who has been exposed to an NFE extension project plants the recommended seed and uses chemical fertilizer during the planting season directly following the end of the project. However, if the analyst does not investigate further, he might fail to discover whether or not the farmer continues to follow the recommended practices. The point is that immediate skill application outcomes are often misleading and, in any case, less significant than long-term, more enduring results.

> A bridge built, some cattle innoculated this year, a health mystery solved, a school of industrial arts established -- these are not always considered the ultimate tests of the success of development projects. The ultimate test to be applied may be whether or not the project generates its own continuing and expanding activity. Have the new methods and training been incorporated into the normal life of individuals and communities, and do they persist and spread? Can the area now build its own bridges, and will it continue to do so? (Hayes 1966, p. 24).

In order to measure the lasting impact of the project at the skill application level, you might consider an extended premeasurement-postmeasurement design which includes outcome assessment at one or more periods of time after the end of the project, as follows:

Premeasurement of habits or practices → project → immediate postmeasurement → extended postmeasurement

This extended measurement design need not be followed through with the entire group of participants. Sometimes the best way to obtain information over an extended period is to select successive samples of similar types or to choose a sub-sample for intensive study. (This is described in Appendix C and again in Step 7).

Frequently, however, long-term data are difficult to obtain or the time frame of the investigation does not permit extended data collection. When this is the case, you might consider as a significant proxy measure, "the extent to which project activities have been institutionalized" (Hayes, 1966, p. 25). Thus, you might ask whether the farmer has made any long-term commitment to the new activity (e.g., purchased land, changed the pattern of crop rotation, planted a long-term cash crop such as tea, purchased new tools) or whether the community has built a new development center, and has provided an adequate budget for its staffing and maintenance.

Another major consideration in outcome evaluation is the extent to which the results are linked to the NFE project in question. As the investigation moves further away from immediate educational outcomes and addresses outcomes in the social, political, and economic areas, it becomes more difficult to separate the effects of the project from many other outside causes. In the great enthusiasm for NFE and its potential social impact, it is often forgotten that education is only one of the many methods for affecting intended behavioral outcomes. In many cases the desired outcome can be brought about much more economically through changes in factors outside the educational sector. For instance, use of fertilizer might be encouraged more economically by subsidizing the purchase price than by a project that trains farmers. The use of a separate comparison group with characteristics similar to the NFE project group allows the evaluator to separate the outcomes which may have occurred "with or without" the project.

In Step 5, we discussed the possibility of creating a comparison group either by random sampling or by reconstructing a group whose characteristics generally matched those of the project participants. In his UNESCO manual on project evaluation, Hayes (1966, p. 82), describes another method of establishing a comparison group. This method, which is especially valuable at the skill application and development outcome levels, involves the separation of a geographic area such as a region or district, which includes the target group but is larger than the area of expected project influence. After collecting baseline data in the target area and in the comparison area, the investigator then compares the changes which have occurred in the area with those in the larger area. Care must be taken, however, to identify non-project factors in both areas which may affect the results.

Remember that in using any comparison group design, measurement has to take place under reasonably uniform conditions, and project activities should be observed to assure that the "control" group is not exposed to the experimental treatment.

C. SELECT AND IMPLEMENT DATA COLLECTION TECHNIQUES

The most commonly used data gathering techniques at the skill application level are: unobtrusive measures, direct observation, participant self-reports, interviews, questionnaires, and case studies. The choice of which to use depends not only on the questions to be answered, and the accuracy of the data, but also upon the capacity of the

Table 6.2

METHODS OF ASSESSING SKILL APPLICATION OUTCOMES BY EVALUATION CAPACITY VARIABLES

			Capacity Variables*		
Methods	Trained Interviewers	Literacy of Respondents	Transportation Facilities	Knowledge of Local District	Staff Time Required
Unobtrusive Measures	low	-	low - medium	low	low
Direct Observation	high	low	low - high	high	high
Participant Self-Report	-	high	low	high	low
Interview	high	low	low - high	high	medium
Questionnaire	medium	low - high	low - high	high	medium
Case Study	high	low	low	high	high

*Estimated ranking based on typical small-scale, geographically concentrated NFE project.

project investigator to conduct the necessary activities. The selection of one technique (such as an interview guide to be used in a random household survey) might depend on a variety of factors, such as the availability of trained interviewers, the literacy of the respondents, transportation facilities, knowledge of the local dialect, and staff time required. Table 6.2 provides a general ranking of the characteristics of each data collection technique in view of these variables.

In this section, we shall briefly review the major characteristics of the six data collection techniques as they apply to the assessment of outcomes at the skill application level. Some of these assessment methods have been discussed before in Step 5 with regard to the specification of educational outcomes.

1. Unobtrusive measures

These are data which are available to the project investigator, but which are not collected in conjunction with the particular NFE project. Basic sources for such data include government agencies and such private or semi-private organizations as churches, farmers' cooperatives, church sponsored clinics or schools, tribal associations, political groups, local businesses, libraries, etc. These groups regularly collect formal data (census figures, enrollments, sales records, loans issued, memberships, clinic visits, or land sales) and often informal data (shop credit granted, field notes, local dispute records, or meeting notes) which can prove to be useful sources for the identification of expected changes and of factors which explain the skill application results.

Unobtrusive measures have the advantage over other measures of not requiring great amounts of staff time, the knowledge of the local dialect, or highly trained interviewers or observers. They also are the least likely of the common assessment methods to influence participant performance and project results. The use of unobtrusive measures, however, requires some care. Often institutional data collected by government or private agencies may be incomplete or incorrect. They may also be defined and listed in a manner which is unexpected by an outside user, and therefore, can be misleading. Unless you know for a fact that the unobtrusive measures you select are reasonably sound, they should not be used as the sole source of verification of the project results. Rather, it is best to use most unobtrusive measures to cross-check the results provided by other data-gathering techniques.

2. Direct observation

This method, when used by trained and experienced observers, can give valuable qualitative and quantitative information unavailable from other data collection methods. Direct observation is especially useful when the investigator needs to obtain information about individual or group interaction (such as, if and in what manner the participants in a project take initiative and join in cooperative effort to solve problems). In addition, this data collection method allows a project analyst to obtain frequency counts and to determine the size and nature of local occurrences (e.g., community meetings, harvests, housebuildings, disease treatments, and job hunting). Such qualitative and quantitative information can be collected both before and after the NFE project has taken place so that the behaviors identified can be compared, and with the use of a comparison group, related back to the project. Of all data collection methods, direct observation can provide a project evaluator with the most valid and reliable method for understanding the processes by which project outcomes came about.

Ideally, the observer should live or work close to where the activities he wishes to observe take place. Depending upon the nature of the project and the social setting in which it occurs, direct observation can take place in at least three ways. First, behavioral observation of project participants or non-participants can be made from the project site. A second type of observation involves regular visits to the selected units of observation. Such visits should be made on a regular schedule which allows the observer to note routines and happenings. Witnessing important special events (meetings, the opening of a cattle dip, funerals) is a third form of direct observation.

Disadvantages connected with direct observation include high amounts of staff time required, lengthy training for observers, bias in recording observations and in selecting what to record, incomplete recording of significant behavior, and misinterpretation of events witnessed. Some of these problems, however, may be diminished by following the basic principles listed below.

Some Basic Principles for Direct Observation

1. Make the purpose of the observation clear and in accord with the purpose of the evaluation.
2. Maintain reasonably uniform conditions for observation.
3. Separate facts from impressions and interpretations.
4. Avoid classification of observations in terms of your own cultural experiences.
5. Verify the information obtained by using statistical data, photographs, participants' self-reports, etc.
6. Select your units of observation so that they are reasonably representative of the target group as a whole.

3. Participant self-reports

This method involves the recording of personal experiences or thoughts and feelings by the project participants in a free and spontaneous way. Self-reports can include diaries, logs, frequency counts, accounts of special incidents, and so on. Such reports provide information which may be difficult to obtain by observation or questioning, and which may be especially useful for indicating factors affecting the application of learned attitudes, knowledge, or skills.

Self-reports, however, may be difficult to interpret and may be misleading due to definition problems and the writer's motivation in providing information. Such reports, therefore, should be balanced by observations, statistical data, and other information. This data collection technique, moreover, can be drawn upon only if the project participants are highly literate and have good writing skills.

4. Interviews

These are structured or unstructured discussions with participants and others involved in the project. Structured interviews have the content and order of questioning prepared in advance. Unstructured interviews are basically open discussions which allow the interviewer to follow particularly interesting or useful areas of conversation.

Such discussions with participants, staff, and community members are especially useful when they take place along with direct observation. Follow-up interviews, based on observations can clarify the meaning of complex or unexpected behaviors witnessed and add to the understanding of behavioral interrelationships. Informal interviews are also a means of obtaining information about participants' backgrounds and behaviors difficult to observe, such as family planning, household decision-making, or job hunting, and of receiving opinions about events or practices.

Frequently, responses received during interpersonal interviews may not be entirely true due to a number of factors which can include distrust regarding the use of the information requested, misunderstanding, embarrassment, defensiveness, false knowledge, or eagerness to please. The more highly trained, experienced, and sensitive the interviewer, the better interview information will be. Nevertheless, there are some basic interview procedures, which given limited resources for staff training, can help to improve the quality of the information received. Once information has been obtained and checked for consistency, it must then be matched against other interviews and reports, statistical data, and recorded observations of actual behavior.

Some Basic Techniques for Obtaining Information During Interviews

1. Clearly explain the purpose of the interview and the intended use of the information requested.
2. Help the respondent feel at ease.
3. Ask for essential information only.
4. Keep the interview as brief as possible.
5. Adapt questioning to interview conditions such as the presence of onlookers or special manners required in asking for information.
6. Use a checklist of questions as an interview guide.
7. Begin the interview with broad questions and become increasingly specific.
8. State questions in terms that are familiar to the respondent.
9. Use discretion when asking questions on sensitive topics.
10. Ask questions without leading the respondent or biasing the response.
11. Explore further vague, ambiguous, or incomplete answers.
12. Check consistency by asking the same key questions in different ways.

5. Questionnaires

In developing countries, prepared and pretested questionnaires are most often applied as a structured interview with one respondent at a time. In some cases, where literacy is high among the target group, respondents may fill out questionnaire forms themselves. However, it is best, even in such cases, that a trained interviewer be on hand to make sure instructions are clear, and to collect the forms after they are finished.

The questionnaire method differs from that of the interview, since the questions asked in a questionnaire are decided and structured before they are used and are not changed in individual situations. Unlike the interview, the questionnaire assures uniformity, requires less training of interviewers, and takes less staff time for analysis. However, since the questionnaire must be completed by the respondent "as is," without question substitution or further explanation, preparation requires considerable planning and careful pretesting to uncover difficulties before using. Pretesting must include application by an assortment of interviewers (whose skills may differ considerably) as well as application to a wide range of individuals with characteristics like those in the target group.

Questionnaires may contain open-ended or fixed choice items. Open-ended questions allow respondents to give their own answer or explanations, but analyzing the data is difficult. Fixed choice items provide respondents with few options and no opportunity for explanation. Questionnaires may also include checklists or ranking scales which are relatively easy to analyze.

The project investigator may need to develop an original instrument or may be fortunate to have existing questionnaires available from which questions can be selected and adapted. A particularly useful source of questions regarding economic variables in developing countries is the "Standard Package of Economic and Demographic Questions" compiled by Freedman and Mueller in 1976. This is a collection of question-modules designed to uncover information regarding characteristics of household members, fertility and health, migration, occupation and employment, and household income and assets. Such modules can be adapted to fit the characteristics of the social and environmental area in which the questionnaire is to be used.

Both informal interviews and questionnaires, when used for surveys, census, or tracer studies, must be applied to appropriate respondents in a standard unit of analysis. For example, the evaluation design may specify a specific sample of households, farms, nuclear family units, or age grades. If the unit includes a group of people, such as a household, respondents should be chosen from those who can serve as the best source of information. If you require information about nutrition, the household person who does the cooking may be the most appropriate source. If data are needed concerning income and expenditures, the household head may be the most suitable respondent. Whichever person is chosen, however, the position must remain uniform across interviews if the results are to be comparable.

6. Case studies

The case study technique is a valuable complement to surveys and other "snapshot" methods in which the data collected are frozen at one point in time. The technique basically provides an excellent detailed account of socioeconomic change. It allows a project investigator to analyze the dynamic manner in which new skills are interpreted and used by project participants to suit their particular needs and circumstances.

A case study is usually a composite of direct observation, wide-spread interviews, and content analysis of reports and records. The technique is used to magnify either the details of a particular situation or event, or the behavior of an individual, as it is influenced by a network of interpersonal relationships over time. The qualitative information derived from this intensive technique can provide invaluable insights, not available from any other single method, into project impact on the social life of the local society. Such insights are extremely beneficial for pin-pointing key variables to be followed up in large sample surveys and for explaining unexpected results from larger evaluation studies.

This approach to the examination of the events under consideration can, however, be very time consuming and requires highly trained and experienced personnel. It may also provide data which are biased, difficult to verify, and not generally applicable. If you decide to use this technique, choose your cases carefully (illustrative situations in the target area or "typical" individuals in an identifiable subgroup of the target population), document your findings, and be sure to relate the results to statistical data from other sources.

Use Worksheet 6.1, Assessment Strategy for Intended Skill Application Outcomes, to record your selected indicators, design, and data collection techniques for each of the skill application outcomes to be reviewed. This worksheet is a duplicate of Worksheet 5.1, used for the assessment of intended educational outcomes.

D. INTERPRET AND ANALYZE THE RESULTS

Field data derived from any of the six collection methods discussed may be organized for statistical analysis into categories, frequencies, time intervals, and rating scales. As noted in Step 5, the more structured the assessment instrument used, the easier the tabulation and analysis.

SCOPE Worksheet 6.1

ASSESSMENT STRATEGY FOR INTENDED SKILL APPLICATION OUTCOMES

Project Name: ______________________ Date: ______________

Indicator	Design	Data Collection Technique	To Whom	By Whom	When

The preparation of all data requires that they first be closely checked for completeness, appropriateness and accuracy. Objective items on questionnaires should be precoded when possible to save time during data analysis. Free response data from interviews and questionnaires, records of observations, and the contents of reports must be reduced to simpler terms for classification and statistical treatment. The State of California, Project Evaluator's Guide (1977:D32) gives a basic method of treating complex information such as conversations, diaries, or descriptions of activities. The method is outlined below.

1. List all responses or data of interest.
2. Form basic categories suggested by a review of the data.
3. Classify the data by category.
4. Combine very similar categories.
5. Combine categories with little data or few responses into a miscellaneous category.

For further discussion of data preparation and analysis, see Appendix D.

I. Interpreting the results

The discussion of this topic in Step 5 applies to the interpretation of skill application results as well. However, some parts of the discussion are being repeated here for clarity.

FACTORS IN INTERPRETING RESULTS

Factor	Question to be Answered
1. representativeness	Do you have data which represent the performance of the total target group?
2. length of impact	Do you have the results of a follow-up study to show it is having a continuing positive impact?
3. range of impact	Does the project have educational impact in areas other than the project's intended objectives?
4. strengths and weaknesses of instruments used	Were the instruments valid, reliable, and appropriate?
	Did the instruments allow people to directly or indirectly demonstrate their skills, knowledge, or attitudes?
5. strengths and weaknesses of the design used	Can the outcomes be attributed to the project factors alone?
	Was the comparison group equivalent to the project group and were they exposed, in any way, to the project?

In the assessment of NFE projects, it is often not possible to select participants by random sampling, to assess long-term outcomes, to investigate broader educational objectives, to use highly reliable measures, or to have an ideal design. The funds may not be available, decisions cannot wait long enough, experts may not be available to provide assistance, the evaluation may have been an afterthought, and you may not wish to invest your own time. Therefore, you must report your results with due caution and indicate both their limitations and strengths.

2. Analyzing the results

In explaining why the results occurred as they did, attention should be directed to the relationship between project design and intended outcomes within the context of other physical and human environmental conditions. If, for example, a project teaching farming techniques has poor skill application results, one reason may be the educational approach used. However, the problem may not be in the educational design at all, but may be caused by outside factors such as the person's control of land and labor, his investment capital, his access to credit, storage facilities, marketing channels, transportation, and so on.

When analyzing development projects, it is very difficult to connect effects to causes based on the extremely complex relationship that exists between multiple variables. Yet, it is important to try to analyze project results and at least identify relationships among variables since such an analysis will occur (and be reworked into future project planning) whether or not it is undertaken systematically.

In assessing skill application, there are three major areas to investigate for factors which may substantially affect the achievement of project objectives. Two of these -- the structure and organization of the project, and the characteristics of the target group were discussed in Step 5. The third area includes many local social and physical environmental conditions which are outside the project.

Some Factors Affecting Skill Application Outcomes

- complementary local projects or development activities
- provision of relevant materials and supplies
- employment conditions
- market access
- land use
- physical structures
- ecological setting and potential
- prevailing attitudes and social ethics
- political environment
- local experience with previous development projects
- community economic practices and resource use
- institutional structures and capabilities

On Worksheet 1.3, Review of Project Assumptions, you indicated a series of assumptions about the relationship of external factors and their expected effect on the outcome of the project. As suggested in Step 5, this worksheet provides you with the first clues as to which of the project, target group, or external local environmental factors are the most likely to have affected project success. In determining whether underlying project assumptions were realistic, you can provide information which points to needed project modification and which justifies use of the findings in other settings and problem areas.

SCOPE Worksheet 6.2 (page 1)

ANALYSIS AND INTERPRETATION OF INTENDED **SKILL APPLICATION OUTCOMES**

Project Name: ______________________ Date: ______________

INTENDED OUTCOME (abbreviate)	INSTRUMENT (abbreviate)	RESULTS (Use separate sheet as necessary)	LIMITATIONS	EXPLANATORY FACTORS (Use separate sheet as necessary)
SO 1.				
SO 2.				

SCOPE Worksheet 6.2 (page 2)

ANALYSIS AND INTERPRETATION OF INTENDED **SKILL APPLICATION OUTCOMES**

Project Name: ______________________ Date: ______________

INTENDED OUTCOME (abbreviate)	INSTRUMENT (abbreviate)	RESULTS (Use separate sheet as necessary)	LIMITATIONS	EXPLANATORY FACTORS (Use separate sheet as necessary)
SO 3.				
SO 4.				

Use Worksheet 6.2, Analysis and Interpretation of Intended Skill Application Outcomes, to describe your analysis techniques, your findings, their limitations, and the explanatory variables. This worksheet is a duplicate of Worksheet 5.2, used for the analysis and interpretation of intended educational outcomes.

E. CHECKLIST

The basic checklist of substeps and tasks for specifying skill application outcomes is the same as that used in Step 5 for educational outcomes. In addition, be sure to:

- investigate more than the immediate skill application behavior at the end of the project by using follow-up studies
- link results to NFE project by using an appropriate comparison group design
- avoid major problems associated with the different types of social data collection techniques by careful planning prior to use
- properly prepare and simplify complex data prior to analysis
- analyze results by referring to project, target group, and external environmental factors

CHECKLIST OF SUBSTEPS AND TASKS FOR SPECIFYING SKILL APPLICATION OUTCOMES
(STEP 6)

SUBSTEP	TASK	COMPLETION DATE
A. Identify planned outcomes and performance indicators	A.1 Review learning objectives stated on Worksheet 1.1	
	A.2 Where objectives are unclear or not directly measurable, select proxies which characterize components of desired change	
B. Determine the evaluation design	B.1 Decide which data elements are needed for the evaluation	
	B.2 Select a standard against which to compare each educational outcome	
C. Select and implement data collection techniques	C.1 Identify what type of project data are being or have been collected and what assessment instruments are locally available	
	C.2 Choose reliable and comprehensive instruments which are suited to the respondents, social setting, and management structure at hand	
	C.3 Select multiple measures for difficult-to-measure or high priority outcomes	
	C.4 Review new assessment instruments with knowledgeable local persons, field test, and revise as necessary	
	C.5 Train personnel and assign work responsibilities	
D. Analyze and interpret the results	D.1 Summarize data and, if necessary, apply tests of statistical significance	
	D.2 Determine measurement limitations	
	D.3 Explain why the results occurred as they did	

SECTION D

STEP 7

SPECIFY DEVELOPMENT OUTCOMES: INTENDED AND UNINTENDED

Thus far, we have been concerned with assessing the effectiveness of NFE projects. In Step 5, we asked how well an NFE project transfers a given set of knowledge and skills to its participants while in Step 6 we went one step further to find out if the participants applied these skills and knowledge in related work, homelife, group, and community activities. This type of information is important to evaluate and implement projects. However, this information does not provide a sufficient basis for assessing the social desirability and/or profitability of the investment in the NFE project.

Indeed, when NFE projects are designed and assessed from the perspective of the country's development strategy, we see that educational and skill application outcomes are really "means" for achieving specified developmental goals rather than "ends" in themselves. It is usually the economic and social changes that result from the application of skills and knowledge learned through the NFE project, not the skill itself, that is of value to society. For example, we must ask not only if local farmers participating in the NFE agricultural extension project learned and applied the principles of crop rotation, but what happened as a result of their participating in the project and using the new crop rotation system.

The same logic and procedures developed and explained in Steps 5 and 6 are applied in the following sections to the tasks of identifying and measuring economic and social changes associated with the project. First, indicators of the anticipated changes are identified, then, corresponding evaluation designs and measurement procedures are chosen. Once the best combination of indicators, design, and measurement techniques are selected, data can then be collected, analyzed and interpreted.

A. IDENTIFY INDICATORS OF ECONOMIC AND SOCIAL CHANGE

In general, NFE projects are designed and implemented as a part of a broader development strategy, and the development goals identified in the Step 1 project overview suggest the ways in which economic and social changes should be measured. These or targeted outcomes usually occur as greater productivity, increased equity, better health, improved family life environments, increased employment, socioeconomic mobility, and greater political awareness and effectiveness. Since these goals are often stated in very general terms, the first task of the investigator is to review the Overall Development Goals from Step 1 and state them in a form to describe the changes which occur as clearly as possible.

The investigator must then identify corresponding indicators of change which measure the effects which we want to study, and which can be implemented within the limits of the evaluation's time and budget. Ideally, the set of indicators should provide information stating what changes in productivity (health, family life environment, equity, socioeconomic mobility, political effectiveness, etc.) occurred or can be expected to occur as a result of the application of skills and knowledge acquired through the NFE project. To be most effective, the indicator system should also provide information which tells us the dimensions along which the change occurred, how much change occurred along each dimension, when this change took place, for how long and who was affected by the change. Although many of the social and economic changes associated with NFE projects are difficult to quantify, the investigator should not be too easily discouraged from this important task. As Blaug (1970:124-125) argues,

> For most purposes, an index or scale that is at least semi-cardinal must be found for each objective, that is, one that has intervals which have meaningful units of width; we must be able to say 'how much more' not simply 'more' or 'less' ...

In addition to identifying indicators of direct economic and social changes which are expected from the project, the investigator should also consider indicators which provide indirect evidence that these changes occur. As we have seen in the preceding steps, the use of several instruments can significantly increase the accuracy of the findings of the evaluation. In addition, where it is difficult to construct good measures of project outcomes the indirect measures can be used to validate assumptions about the effect of the project. Examples of economic and social development goals and corresponding direct indicators of change are listed in Table 7.1. For example, the application of crop rotation techniques from an NFE project might increase farm productivity in such ways as greater output, increased quality of harvested crops, production of higher-profit crops, and/or savings in the various farm processes.

Clearly, NFE projects will differ in how well indicators of economic and social change corresponding to development goals can be specified and measured. In some cases, particularly where the projects are aimed at social and political goals rather than economic ones, the links between the skill application outcomes and the broader development process may be complex and involve many unknown factors. Corresponding development outcomes will naturally be difficult to specify and develop in such a way that change can be measured. In many other cases the anticipated economic and social outcomes will occur in the future, introducing difficult measurement problems. Project design can impose additional limits.

Table 7.1 (page 1)

EXAMPLES OF DEVELOPMENT GOALS AND CORRESPONDING INDICATORS OF ECONOMIC AND SOCIAL CHANGE

DEVELOPMENT GOAL	INDICATORS OF SOCIAL OR ECONOMIC CHANGE
greater productivity	increased output better quality of output cost savings in the production (or growing, etc.) process increased wages greater employment stability accelerated progression of earnings
increased employment	lower rate of unemployment unskilled workers able to find and hold off-farm jobs

Table 7.1 (page 2)

DEVELOPMENT GOAL	INDICATORS OF SOCIAL OR ECONOMIC CHANGE
better health	physical growth patterns approach those of population norms lower mortality rates reduced incidence of specific diseases fewer sick days
better family environment	improved living facilities better communication and/or cooperation among family members
greater political effectiveness	increased attention from regional and national political figures and organizations favorable tax changes increase in governmental programs benefitting the area

Table 7.1 (page 3)

DEVELOPMENT GOALS	INDICATORS OF SOCIAL OR ECONOMIC CHANGE
increased socioeconomic mobility	designated populations are able to obtain and keep jobs previously closed to them increased income for designated population increased education for designated population
increased equity	income or wealth of designated population increases programs and services are directed in greater proportion to designated population designated populations have greater access to and use of facilities and services disparities between groups in society are reduced or eliminated

Thus, we find that in some projects, indicators of change stop with the skill application outcomes data while their broader development consequences and values are based on assumptions. In other projects, it is possible to obtain more reliable measures of economic and social outcomes.

The ultimate choice of indicators for intended economic and social change will depend on not only how well they can be specified, but also on practical considerations related to the feasibility and costs of measuring the outcomes. These issues are discussed in the next sections.

B. DETERMINE THE EVALUATION DESIGN

In order to estimate the economic and social changes which occur as a result of participation in and the application of skills and knowledge acquired through the NFE project, we must compare performance gains for the NFE project participants to those for a similar population who were not exposed to the NFE project. This "with/without" comparison is Design C from Step 5 and is explained there in greater detail.

Possible comparison designs which the evaluator may wish to consider (and combine) in assessing the effects of the NFE project include:

(1) A comparison of the performance measures of the NFE project group with those of a similar group who have not had the exposure to the techniques learned in NFE training. As explained in Step 5 and Step 6, either random placement or population reconstruction methods can be used to select the comparison group.

(2) The experience of an earlier group--for instance, one that finished training two years ago--can be measured and used to approximate the post-project performance of the present NFE group. This "successive group" comparison design is more fully discussed in Appendix C. The measures obtained can then be compared with those of a similar population who were not exposed to the project.

(3) Estimates of the social and economic effects of the project can be made using outside data for two populations with characteristics similar to those of the NFE population. The populations should be similar in all respects except that one group has not had exposure to the information and skills learned through the NFE project while the other group has completed training similar to that provided in the NFE project. The estimated gains from using the new techniques should then be attributed to only that portion of the NFE population which actually applies the new skills.

As discussed in Step 5 and Step 6, each of these comparisons can be made using either postskill application performance levels or differences in before and after scores. In addition, comparison at later points in time using tracer or follow-up studies can provide important information as to whether the project's effects continue at the same level, increase, or diminish with time.

Each of these designs, when used in the evaluation of development outcomes, has certain advantages and disadvantages which the investigator must weigh in the context of the specific NFE project's size, status, and budget. For example, a random project sample assignment may not be possible if the NFE project does not have widespread community support or is implemented prior to the evaluation design. In addition, even where it is possible, the random project assignment comparisons may not be meaningful or statistically significant for NFE projects of small size. Generally, we can see that large group comparisons will be expensive to directly observe and follow over time.

In all cases, the importance of matching the NFE population and comparison groups as closely as possible cannot be emphasized enough. Otherwise, one cannot be sure whether the observed differences are due to the use of the NFE skills and knowledge or other non-matched population characteristics which also affect what is being measured. A similar problem occurs in historical comparisons, since the NFE project exposure and applications are not the only changes which occur in the project population. Environmental factors (such as weather or governmental programs) also change over time and can have considerable impact on economic and social outcome measures. While it is possible to use many sophisticated statistical techniques to control for the effects of these external factors on measured indicators of change, this introduces new sample size requirements and computation complexities into the evaluation. (See Appendix E, A Hypothetical Case Study, for an example of the use of comparison groups.)

C. SELECT AND IMPLEMENT DATA COLLECTION TECHNIQUES

After the various indicators of economic and social change have been identified and relevant comparison groups selected, the investigator must then decide on appropriate instruments and data collection techniques for measuring and estimating anticipated changes. As we indicated earlier, this is an interactive process since the costs of measuring changes in indicator values and the reliability of the data which is obtained will be major factors in choosing the indicators and the evaluation design. Indeed, as we have noted, in some NFE project situations the costs of obtaining reliable measures of social and economic change may be so great that only skill-application outcomes can realistically be measured. Given the project scope and budget, the links between these skill application outcomes and desired economic and social change must be based solely on assumptions from past experience.

Due to the potential of incurring particularly high measurement costs at this stage of the investigation, the analyst should conduct a careful review of possible data collection strategies before making a final selection. Basically, the selection process follows a pattern such as that suggested in Worksheet 7.1. For each potential indicator and comparison group design combination, alternative data sources and data collection methods are identified and their reliability indicated. Estimates of their relative costs are also made. In those cases with quite a few indicator/ measurement options or where (as in many social or political projects) it does not appear that reliable measurements are possible within the scope of the project budget, this process can be used as a screening device. Rough estimates of costs and reliability can be estimated and then the process repeated with greater accuracy once choices have been narrowed to just a few options.

Use Worksheet 7.1, Review of Data Collection Strategies for Intended Development Outcomes, to select a data collection strategy appropriate for your data needs and budgetary constraints.

SCOPE Worksheet 7.1

REVIEW OF DATA COLLECTION STRATEGIES FOR INTENDED DEVELOPMENT OUTCOMES

Project Name: ______________________________ Date: ______________

INDICATOR	EVALUATION DESIGN	DATA SOURCE	ESTIMATED COST OF COLLECTION	ANTICIPATED RELIABILITY AND VALIDITY

There is a wide range of data sources and data collection techniques which the investigator may wish to consider in light of the NFE project design and budget. These range from direct observation of the population's economic and social change as specified by the indicators, to estimates of change using outside data sources to approximate the experiences of the NFE project and comparison populations. Since the economic and social changes associated with the NFE project are generally expected to occur and/or to continue well into the future, the investigator must also determine the frequency and timing of the collection of performance data or the number of measurements per subject to be used.

The same general rules discussed in Steps 5 and 6 apply to the selection and development of data collection techniques for the measurement of economic and social change.

(1) The data which are collected and used in the evaluation should measure the economic and social changes that have been specified from the project's broader development goals.

(2) The investigator should use and build upon available data and local data collection instruments and techniques wherever possible.

(3) The development of new instruments should be minimized and if necessary made as simple as possible.

The following guidelines can be used in developing a data collection strategy.

(1) Collect relevant data from comparable projects in other areas.

(2) Identify potential local assessment instruments which have previously been used.

(3) Identify personnel who can act as observers, interviewers, or research aides.

If you plan to use available outside data, these should be reviewed with respect to the following questions:

(1) Do the data measure the primary economic and social changes we have identified from the development goals of the project?

(2) Do the data measure indirect changes which would indicate that the specified changes have occurred?

(3) Are the data representative of the NFE project population with respect to relevant characteristics such as age, income, land holdings, region, urban states, etc.?

(4) Do the data include other outside influences so that we cannot tell whether the measured changes result from the application of NFE skill or other factors?

(5) Is the sample of sufficient size and completeness for our purposes?

Use Worksheet 7.2, Preliminary Assessment of Available Outside Data Sources, to review useful sets of information from comparable projects or statistics collected for other purposes.

Instruments which are available locally should be reviewed to see if they can be used to assess the changes we wish to measure. It is also important to determine if the survey or questionnaire is culturally appropriate for the area, and if available personnel are qualified to administer the evaluation. Finally, estimates of the cost of using and/or adapting available sources to the needs of the evaluation should be determined.

SCOPE Worksheet 7.2

PRELIMINARY ASSESSMENT OF AVAILABLE OUTSIDE DATA SOURCES

Project Name: ______________________________ Date: ______________________

DATA SOURCE	POPULATION CHARACTERISTICS	SAMPLE SIZE AND COMPLETENESS	VALID MEASURE OF DESIGNATED CHANGE	INDIRECT MEASURE OF DESIGNATED CHANGE	EXOGENOUS FACTORS	ESTIMATED COSTS OF USING DATA

The investigator should then consider possible new data collection efforts and ask if anything can be gained by using these new assessment instruments and what it will cost to use these methods. Additional information can be collected through direct observation, from reports by participants in the project and comparison groups, or by staff and local community members. Other unobtrusive measures were discussed in greater detail in Step 6.

Direct observation of the project and of the comparison group's performance by qualified people offers the opportunity to collect very detailed and reliable information in social areas which are complex and difficult to measure. For example, in an evaluation of a nutrition project, periodic examinations by doctors and other specialists can show how children's health improves and by how much. Similarly, actual weighing and measuring of harvests or the estimation of these statistics by agricultural experts provides a solid basis for measuring increased productivity associated with an agricultural extension NFE project. However, in order to provide reliable information, this method of data collection is likely to be very costly. The information must often be collected by highly qualified individuals (whose time is scarce) and/or by less qualified people who have been trained in using very specific observation instruments (which can be difficult and costly to develop and test). Therefore, these methods may be less appropriate for measuring economic and social outcomes than for assessing skill application outcomes. A major exception would be the use of detailed case studies in which direct observation of a few project subjects or a specific situation helps the observer to understand the processes by which the economic and social changes occur and the timing and duration of these changes. Case studies also can be very effective in suggesting possible change indicators and assessment instruments for a larger project evaluation.

Reported information, as we noted in Steps 5 and 6, can take many forms: questionnaires, interviews, individual progress reports, diaries and logs. In general, the questionnaires and interviews give the investigator more control over the information which is collected, but they are more difficult and costly to develop and administer. The logs, diaries and individual progress reports are more easily obtained, but are unstructured and likely to be inconsistent and vague.

Since the reported information depends upon the perceptions, training, and memory of the subjects, it may be more reliable for questions related to individual actions (such as those discussed in Step 6) rather than those concerning economic and social performance levels. However, in nearly all cases, information collected in this way can be valuable in checking the accuracy of various assumptions which have been made about the impact of the NFE project and the results from other data sources. Various uses and sources of reported information discussed in Step 6 should be reviewed and applied, where relevant, to the measurement of economic and social change.

Unobtrusive data from individuals and institutions who interact with the NFE project populations or similarly reconstructed populations can be particularly important in measuring economic and social change outcomes. This information can either be collected at the request of the investigator, in which case it is most likely to correspond to the designated indicators of economic and social change, or it can be processed from the records naturally kept by the agents as a part of their transactions with the NFE subject population. The sources for this data would, of course, depend upon the subjects taught in the NFE project and the business and social structure of the area in which it took place. A brief review of the pattern of actions and transactions in the relevant economic and social activities would identify likely data sources. These could include institutions (health clinics, taxing authorities, or agricultural extension agencies), organizations (agricultural cooperatives or political groups), business agents (grain buyers, suppliers of fertilizer and protein supplements, local shopkeepers), and individuals (technical assistance personnel or town leaders).

The above data sources may have certain biases or problems which can affect the measured outcomes. Not all of the project participants may meet with the selected interviewer (for example, not all subjects will attend the health clinic or sell their crops through the village's agricultural cooperative). If the subjects for whom data are available differ in any significant way from the larger NFE population (e.g., if they are younger, larger land holders or better educated) the measured outcomes may be biased -- that is, the measured differences in the performance levels of the NFE and comparison populations may be due to the characteristics of the group for whom data are available as well as to the knowledge gained from participation in the NFE project. Other problems may occur if the event or transaction which is recorded includes the entire economic or social outcome which is to be measured. For example, if only part of the increased produce is sold through the

SCOPE Worksheet 7.3

ASSESSMENT STRATEGY FOR INTENDED DEVELOPMENT OUTCOMES

Project Name: ______________________ Date: ______________

INDICATOR	DESIGN	DATA COLLECTION TECHNIQUES	TO WHOM	BY WHOM	WHEN

local agricultural cooperative (home consumption also increases as a result of the increased yield), the cooperative data will understate the project's outcomes. These and other problems should be noted and their likely effects on the measured outcomes considered when results are interpreted.

The implementation of the data collection strategy, once decided, follows the procedures outlined in Step 6. Appropriate survey instruments must be developed and pretested. Progress reports and record keeping formats should be outlined and suggested to the participants, and qualified personnel for the actual data collection must be recruited, trained, and assigned work responsibilities.

Use Worksheet 7.3, Assessment Strategy for Intended Development Outcomes, to plan your evaluation of the social and economic changes which are expected to result from the project.

D. IDENTIFY UNINTENDED OUTCOMES

Up to this point, our discussion has been directed only to the specification of intended outcomes. We began with these outcomes because they provide a base around which we could develop an evaluation design, and select indicators and data collection techniques. Yet, in reaching a final appraisal of the NFE project, we must take into consideration actual social and economic changes which result from the project, whether or not these were intended.

Unintended project outcomes are sometimes called side effects, by-products, secondary effects, or multiplier effects. Some serve to reinforce intended outcomes, while others may have a negative effect. For example, in an agricultural extension project aimed at increasing maize production, a positive side effect may be additional sales for grain merchants. A negative side effect may be a decrease in coffee production due to overlapping labor requirements during peak periods in the crop production cycle.

Some side effects are very serious and may overshadow the achievement of intended outcomes. Classic "side effects" of this type include family malnutrition associated with new production emphasis on cash crops and failure to supplement diminished subsistence production with purchased foods, and reduced employment for local craftsmen as a result of the local employment of participants in a new vocational training scheme. Other side effects are so significant that they overcome the fact that the project falls short of achieving its major intended impacts. These may include such outcomes as marketable employment experience for village adults serving as instructors or staff assistants in the project, increased government attention and budget allowances for the target area in matters outside of the project, heightened awareness by local extension staff of previously neglected categories of farmers (small-holders or female farm managers), and increased enrollment in primary school of the daughters of participants in a women's vocational training scheme.

In planning the assessment of side effects, you should first determine what type of unintended outcomes might be anticipated for the type of project you are evaluating. Determining, before the evaluation, a range of possible project outcomes, permits the collection of appropriate baseline data, and therefore the necessary before and after comparisons are easier to make. There are several ways of identifying possible side effects before the project evaluation. First, you can consult with experts in the appropriate content area or persons familiar with the target group and the local setting. Second, you can study the records of similar projects conducted elsewhere or of different projects conducted previously in the target area. A third method is to examine the kinds of intended outcomes which can easily be transferred to closely related activities, e.g., the transfer of learned farming techniques and principles from one crop to another.

Project outcomes which were unsuspected may be identified after the fact from information gathered from open-ended questionnaires, interviews, direct observation, participant reports, case studies, unobtrusive measures, and the reports of persons indirectly affected by the project. Another excellent source of information concerning project side effects are project dropouts or persons who did not apply that which they were expected to learn. This group, in particular, may have learned something altogether unexpected from the project or may have applied intended knowledge or skills in different ways.

Once the nature of unintended outcomes has been identified, proper evaluation requires that these outcomes be linked to the project in question. In a manner similar to that described for intended outcomes, this can be accomplished through the use of an appropriate comparison group or comparison area. The investigator also needs to assess unintended outcomes in terms of their size, their timing, and in terms of who was affected. Naturally, you need to be selective in seeking out and measuring project side effects, since these are time consuming and often difficult activities. Yet, any investigation which concentrates only on intended outcomes is seriously deficient in that it runs the risk of missing the project's most critical impacts on social and economic change.

E. INTERPRET AND ANALYZE THE RESULTS

After the data have been collected, they must be combined and analyzed to provide meaningful information about the effects of the NFE project. Relevant techniques for editing, classifying, coding, tabulating, and summarizing the data are detailed in Appendix D, and should be reviewed at this time. In addition, outside technical assistance in data processing and statistical techniques should be investigated and, where possible, used to resolve remaining uncertainties and statistical problems.

1. Interpreting the Results

After the data analysis has been completed for all the indicators, these results must now be assessed and summarized in a form that best describes the economic and social changes that occurred or can be expected to occur as a result of the application of skills and knowledge acquired through the NFE project. A simple procedure for doing this is to list each of the development outcomes that were intended for the project. Then specify in what ways and how well you were able to measure these outcomes. Unintended outcomes should be similarly summarized and measured.

The most basic question is, of course, whether it has been possible to specify and measure directly indicators of these changes or whether we have to rely on assumptions about the impact of the project. In the latter case, the specific assumptions should be noted along with evidence which was collected or is available concerning their accuracy. It is also useful to indicate the conditions which are necessary for the assumptions to be correct.

Where indicators have been specified and measured, the validity and reliability of these processes should be reviewed:

> Do the indicators directly state the changes in which we are interested?
>
> If they are indirect measures, how closely associated are they with the direct change?
>
> Have problems been identified with the data that could affect the results? If so, what is the direction and size of the bias?

In addition, the investigator should consider whether an individual indicator is consistent with other measures or with the findings of similar studies. This review not only indicates the confidence one can have in the evaluation's findings, but also helps to focus the latter application of sensitivity analysis (see Step 10) and suggests reasonable bounds for other "measured" outcomes.

The investigator must also consider if the measured economic and social changes are likely to continue into the future, at what level, and for how long. These "projections" into the future will be based on both present outcome levels and the pattern of change which followed the NFE project. The longer the evaluation is able to follow or trace the NFE and comparison populations, the more confidence we can have in the projections. In addition, the investigator must consider the likelihood of outside changes such as bad weather, new irrigation programs, or political changes which can greatly affect future outcome levels. Again,

SCOPE Worksheet 7.4

SUMMARY OF SOCIAL AND ECONOMIC CHANGES RESULTING FROM THE PROJECT

Project Name: ______________________________ Date: ____________________

DEVELOPMENT OUTCOMES (INTENDED/UNINTENDED)	INDICATOR	DESCRIPTION OF FINDINGS	ESTIMATED PATTERN OF FUTURE CHANGE	LIMITATIONS

sensitivity analysis techniques can be used to set reasonable bounds on outcome values.

Use Worksheet 7.4, Summary of Social and Economic Changes Resulting from the Project, to describe both the intended and unintended development outcomes of the project.

2. Analyzing the Results

Finally, the investigator should ask if there are specific circumstances or factors which have been important contributors to the project's success or failure. As in Step 6, the structure and organization of the project, the characteristics of the population, and local environmental factors may serve as explanatory variables. In addition, when analyzing development outcomes, you should consider national level development strategies and practices which may substantially affect the achievement of expected social and economic change.

Some National Level Factors Affecting Development Outcomes

political force behind the project

complementary national development schemes or projects

local government policies (land tenure, pricing and marketing, credit and subsidies, wages, trading)

government bureaucratic administrative system

availability of further learning opportunities

It is also necessary to assess again the linkages between educational outcomes, skill application, and economic and social change, and to note whether the original assumptions underlying project planning (see Worksheet 1.3, Review of Project Assumptions), were realistic.

WERE THE ORIGINAL ASSUMPTIONS REALISTIC?

Did the target group learn what it was intended to learn?

Why or why not?

Was that learning applied to the participants' real life circumstances in the manner expected?

Why or why not?

Did the anticipated social and economic changes occur or do you expect that they will occur as a result?

Why or why not?

Did other changes (or side effects) occur?

Why?

Use Worksheet 7.5, Diagnosis of Project Outcomes, to explain the results of the project and to identify the implications for project modifications and future planning.

SCOPE Worksheet 7.5

DIAGNOSIS OF PROJECT OUTCOMES

Project Name: ______________________________ Date: ______________

PROJECT OUTCOME	INFLUENCING FACTORS	IMPLICATION

CHECKLIST OF SUBSTEPS AND TASKS FOR SPECIFYING DEVELOPMENT OUTCOMES (STEP 7)

SUBSTEPS	TASK	COMPLETION DATE
A. Identify indicators of economic and social change	A.1 Review development goals stated on Worksheet 1.1	
	A.2 Where goals are unclear, select direct or indirect indicators which can measure the effects you want to look at	
B. Determine the evaluation design	B.1 Review possible comparison group designs in terms of project size, status, and budget	
	B.2 Match NFE population and selected comparison group as closely as possible	
C. Select and implement data collection techniques	C.1 Review alternative data collection techniques in terms of their estimated cost and reliability	
	C.2 Determine the frequency and timing of the data collection	
	C.3 Develop new assessment instruments as required, field test, and revise	
	C.4 Train personnel and assign work responsibilities for data collection	
D. Identify unintended outcomes	D.1 Determine what type of unintended outcomes might be anticipated	
	D.2 Identify unsuspected outcomes after the fact from collected data and project dropouts	
	D.3 Link unintended outcomes to the project by using a comparison group	
E. Analyze and interpret the results	E.1 Combine and analyze data to provide quantification of effects	
	E.2 Estimate the pattern of future change	
	E.3 Determine measurement limitations	
	E.4 Explain the results and identify planning implications	

SECTION D

STEP 8

VALUE AND ADJUST PROJECT OUTCOMES

In Steps 5, 6, and 7 you specified the important outcomes of your NFE project and carefully developed methods for measuring the changes which have occurred as a result of the project. Your next step in the SCOPE method is to prepare your outcome data for use with cost data for various kinds of economic analyses. In some cases, this preparation will require you to assign monetary values to project outcomes. In other cases, it will be either unnecessary or very difficult to assign monetary values.

As in all other steps in this manual, the most important factor to keep in mind while assigning values to outcomes is the nature of the questions which your evaluation is meant to answer. Many questions, especially those dealing with the overall worth of a project, will require you to include all project outcomes, both intended and unintended in your analyses. Other questions, especially those dealing with expanding or cutting back a project, continuing a project, or changing a project design, might require you to focus only on certain selected outcomes. In Step 4 you listed the cost factors associated with these kinds of questions. In this step you should, using the same considerations as in Step 4, determine the outcomes associated with the particular questions your evaluation is meant to address.

Once you have listed these outcomes, then you should examine them and their indicators, looking at the ways in which they were measured and the possibility of assigning them a monetary value. For those which can be expressed in monetary terms, the value should then be calculated and assigned. Other outcomes, the nonmonetary ones, should be at least summarized, using quantitative indicators if possible. Finally the values assigned to your outcomes should be adjusted in ways which will allow them to be used with cost data in the kinds of analyses described in Step 9.

In sum, in preparing outcome data for economic analysis, the following activities are necessary.

A. List outcomes of interest and determine which can be assigned monetary values.
B. Assign monetary values.
C. Summarize nonmonetary outcomes.
D. Make appropriate adjustments.

A. LIST OUTCOMES OF INTEREST AND DETERMINE WHICH CAN BE ASSIGNED MONETARY VALUES

The outcomes which are of interest to you should already have been summarized on Worksheets 5.2, 6.2, and 7.4. It will become immediately apparent to you that some of these outcomes are more easily translatable into monetary terms than others. In general, you will find that the broad indicators of social and economic change related to agricultural extension programs and skill training are the easiest to translate, since they generally deal with factors such as "increased output," "lower unemployment," and "higher wages." Many of these indicators are either already in monetary terms or can be assigned monetary values according to market prices.

Some skill application outcomes which were not further evaluated under Step 7, can also be assigned monetary values. For example, "purchasing seed and fertilizer jointly with other farmers," an indicator of cooperative farming, represents real savings to the farmer, savings can be assigned a monetary value. Other outcomes in this category, such as joining community organizations, are more difficult (if not impossible) to summarize in monetary terms. In addition, most educational outcomes are of such a nature. For instance, estimates of the monetary value of being able to read a local newspaper are highly subjective and generally very unreliable.

When dealing with different kinds of outcomes, educational, skill application and development, it is important to avoid the problem of double counting. Just as in cost accounting, it is possible that a certain outcome has been measured in many intermediate forms. If each of these forms is assigned a value and added to the others, you are likely to overestimate the value of project benefits. For example, if you have decided that a skills development project has permitted participating farmers to increase their earnings by $50 a year (a development outcome), it is inappropriate to add to these benefits the monetary values you might be able to estimate for the application of project skills or the educational outcomes in this area. In sum, you as an evaluator should count as project benefits only the last stage of a series of related outcome indicators.

It would now be useful for you to list again all of the measured outcomes of interest in your evaluation, this time indicating some things about them that will help you in deciding how to prepare them for future analyses. SCOPE Worksheet 8.1 has been designed to help you do this. You could use a single worksheet for your entire project or, alternatively, use one worksheet for each of your evaluation questions.

In the first column of the worksheet, you should list the measured outcomes of your project, both intended and unintended.

SCOPE Worksheet 8.1

VALUATION REVIEW OF PROJECT OUTCOMES

Project Name: ______________________________ Date: ______________________

OUTCOME OR INDICATOR	OUTCOME PRIORITY		MEASUREMENT SCALE	CONFIDENCE IN RESULTS		TARGET LEVEL		ASSIGNMENT OF MONETARY VALUE POSSIBLE?	
	High	Low		High	Low	SPECIFIED	ACTUALLY REACHED	Yes	No
Intended									
Unintended									

It is appropriate here (as elsewhere in this step) to list only actual performance indicators of the outcome. Next you should list whether the outcome is of high or low priority (please refer to Worksheet 1.1 on which you listed the priorities of your objectives). Next indicate the measurement scale of your outcome. This should be a brief reference to the kind of measurement instrument used and the units involved in the measurement, as in "Score on Reading Test (0-5)."

Next you should indicate the degree of confidence you have in the results of the outcome measurement. Some measurements are exact, some are estimates; some involve lots of error, some little. After that, you should indicate whether there was a target specified for the outcome. For this you should refer back to the way in which project objectives were set out in Step 1. In the next worksheet column you should indicate the extent to which the changes you expected actually took place.

Finally, in the last column you should indicate whether or not it would be possible to assign a monetary value to your outcome measure. This, of course, represents a judgment based upon the kind of variable being considered and the data available.

Use Worksheet 8.1, Valuation Review of Project Outcomes, to review important aspects of project outcomes and indicate which ones can be described in monetary terms.

B. ASSIGN MONETARY VALUES

Monetary values can be assigned to project outcomes according to two basic procedures:

1) Determining the market value of the outcome;

2) Estimating the value of the outcome according to market information and various assumptions.

The first procedure is most appropriate when dealing with outcomes involving actual current production or earnings related to NFE projects and questions of greater productivity, cost savings, new markets, and higher quality workmanship. The second procedure is more relevant when dealing with outcomes involving increased skill levels or other economic benefits for individuals and communities which will be realized sometime in the future.

1. Determining the market value of outcomes

The computation of the value of increased production is relatively straightforward, at least in principle. For example, the output of rice per hectare of land (productivity) associated with an agricultural NFE project might increase by an average of 500 kilos. Using the market value of a kilo of rice, the number of additional kilos produced per hectare, and the number of total hectares cultivated by participants in the NFE project, one could determine the monetary value associated with increased productivity. (See the hypothetical case study in Appendix E for good example of this procedure.)

Similarly an evaluation of an NFE project to train master carpenters might have determined that after the course 80% of the participants obtained employment as master carpenters, with an average annual earnings increase of $50 per employed participant. Adjusting to include those who did not find better jobs, the average per participant benefit would have been somewhat less, say $40.

In assigning values as in the above examples, you should take care to adjust for any increase in production costs which result from the application of skills and techniques acquired as a result of the project. In addition, you should consider the project time horizon and record or estimate the value of increased benefit over the entire period, since in most cases project benefits are expected to continue well beyond the operating life of a project.

While assigning monetary values to outcomes in this manner is relatively simple, it is often difficult to determine how much of the change in output is attributable to the NFE project and how much to other factors, such as favorable weather conditions. The analyst should carefully review the data and measurement problems noted in Steps 6 and 7. If as well chosen comparison group was used, such difficulties are minimized, since the favorable conditions are likely to have the same influence on both the comparison group and the NFE group.

It is also possible, particularly in the case of agriculture projects, that not all of the increased output will be marketed. Rather, some benefits will be in the form of increased home consumption which, although it does not reach the marketplace, still represents greater total output and should be valued at market prices. Similarly, negative adjustments should be made for reduced home consumption resulting from increased emphasis on cash crops, or investments and savings. In doing this, the investigator must take care to make reasonable estimates or assumptions about the amount of increased yield which does or does not reach the market. These estimates should be documented and supported.

When the NFE project skills result in a reduction in the costs of producing previous levels of output or a reduction in the costs of providing services (such as health care, transportation, marketing, etc.), the cost savings also represent benefits from the skill application. For example, an NFE project encouraging farmers to purchase seeds and fertilizers jointly might save the participating farmers a considerable amount of money. The value of this savings is the cost of seeds and fertilizer under the cooperative purchasing agreement compared to the costs of the same items under individual purchasing. It is important in counting this kind of benefit to make sure that productivity with the new approach is at least as high as without it.

Increased quality of production has the effect of increasing the price per unit of the item produced. In addition, it is possible that higher quality products will expand the market for these products and increase the quantity sold. The benefits from the application of the NFE skills would be calculated as the number of units marketed multiplied by the price, less the number of units that would have been sold without the NFE skill acquisition multiplied by the unit price without the quality improvements. Adjustments must be made to include home consumption of the products where it occurs and increased production costs. More efficient business practices will also have the effect of increasing the per unit price of the various items and possibly expanding the market. Such benefits would be calculated in the same way.

Finally, it is also possible -- as in the case of projects teaching about equipment maintenance and land management techniques -- that the benefits occur not through new production but by preventing crop losses and lessening the need for equipment replacement. The value of these benefits is calculated as the difference between costs if the losses and damage had occurred, and the costs with new loss-prevention oriented policies.

2. Estimating the value of outcomes using assumptions

This procedure differs from the previous mainly in the degree of certainty associated with the values assigned and the strength of the assumptions used. Market prices are still considered whenever possible, but in some cases they are simply not available for a particular outcome. In other cases, measurement of actual benefits (e.g., worker earnings or output) can be done in the years immediately following the project, but the expense and difficulty of longer term follow-up studies require that they be estimated after that. Examples of outcomes whose values might be estimated using strong assumptions are: future earnings of persons with new skills, future levels of productivity increases and the benefits associated with population gains or losses (a common unintended outcome).

Estimating the economic value associated with skills acquired in an NFE project is perhaps the most common problem of this sort. In many cases the analyst may have data on the immediate employment status and wages of NFE participants (and hopefully their counterparts in a comparison group) but then will have to estimate future earnings increases which result from the project. The increased earnings of the project participants depends not only on the short term wages and benefits the individual receives with the NFE training and those he would have received without the training but also on his projected employment status. Thus the investigator must consider such factors as: how long it takes the individual to find employment, his or her employment stability (e.g., will he/she be periodically unemployed and for how long), promotions, and the likelihood of increased skill acquisitions. The effects of those factors on income streams must be estimated "with" and "without" the NFE training. Clearly there will be a number of assumptions and uncertainties related to those projections which should be noted.

Another common approach to estimating increased earnings is to acquire or compute national (or even better, regional) "earnings by skills" figures and assume that trainees will earn at least the average amount associated with their skill level. Increased earnings, of course, would be computed by subtracting former annual earnings from the projected new annual earnings.

The assumptions associated with such estimations are many and are often quite strong. Some of them are: a) that the trainees will be able to find work allowing them to use the new skills or b) that the trainees can use new skills in upgrading their status or productivity in existing employment; c) that regional differences in the value of certain skills are not severe (a factor if a worker moves from the area of his training); d) that there are no demographic factors such as age, minority group status or sex which would influence the trainee's ability to find and keep appropriate jobs; and e) that the skill will continue to have value over the productive life of the worker.

If in estimating the value of outcomes, certain assumptions cannot be met, it is necessary to adjust the estimates to fit realistic conditions. In any case, the special conditions observed should be carefully documented and an explanation provided for any adjustments made.

Often the monetary value of outcomes can be estimated by referring to previous studies. For example, studies on the effects of certain kinds of diets on human productivity, endurance and resistance to disease, could be used to estimate the per person value of participation in an NFE program in nutrition. When estimates are made in this manner, it is the evaluator's responsibility to document his/her sources and comment on their reliability.

Finally, it may be possible to estimate the monetary value of some outcomes be seeking the judgment of local experts, including the participants themselves. For example, a family head or a village leader may represent the best sources available for assessing the economic implications of outmigration due to the influence of an NFE project. In this case, there are both potential costs and potential benefits associated with the outcome. It is the net benefit which is to be recorded, even if it is negative. And, of course, once again the source of the information, the assumptions made, and the perceived reliability of the estimation should all be documented.

Technically speaking, when project outcomes are assigned monetary values they can be referred to as benefits. Now that you have calculated or estimated the value of your project benefits, they can be summarized on Worksheet 8.2. Be sure to consider the time horizon of your project, and record the benefits over the entire period. The values you have recorded on the worksheet are probably still in current "dollars." They will, of course, need to be adjusted (just like the cost figures) in order to account for time and other factors. Procedures for doing this will be at the end of this step.

SCOPE Worksheet 8.2

SUMMARY OF PROJECT BENEFITS

Project Name: ______________________________

Date: ______________________________

OUTCOME OR INDICATOR	MONETARY VALUE OF BENEFITS					CRITICAL ASSUMPTIONS SOURCE OF INFORMATION RELIABILITY OF ESTIMATION
	YEAR 1	YEAR 2	YEAR 3	YEAR....	TOTAL VALUE	
Intended						
Unintended						

Use Worksheet 8.2, Summary of Project Benefits, to list the assigned values of project benefits and to document assumptions made, sources of information used and the perceived reliability of estimated values.

C. SUMMARIZE NONMONETARY OUTCOMES

It is likely that many or even most of your NFE project outcomes are the kind that cannot be assigned reasonable monetary values. Some of the most common nonmonetary outcome measures in NFE projects are changes in achievement test scores, measures of attitude change, indicators of increased community participation and reduced incidence of disease. Since such outcome measures often relate to objectives of the highest priority, it is essential that they be summarized in ways that will allow them to enter further analyses.

On Worksheet 8.1 you listed your outcome measures of interest and identified those which could not be assigned monetary values. In Steps 5, 6 and 7 we suggested that you record your outcomes in terms of the changes which occurred as a result of the project. Changes in nonmonetary outcomes are often recorded in terms of (a) increases (or decreases) in the numbers of people who behave in a certain way (attend meetings; achieve at a certain level), or (b) the percent of increase (or decrease) of a certain phenomenon, such as literacy or disease incidence.

In all cases you as evaluator should describe the nonmonetary outcomes in as quantitative and systematic manner as possible. Described in this manner, they can be referred to as effectiveness measures and used later on with project costs in cost/effectiveness analyses.

Project Name: ____________

Date: ____________

SCOPE Worksheet 8.3

SUMMARY OF NONMONETARY OUTCOMES

OUTCOME OR INDICATOR	AMOUNT OF CHANGE (Effectiveness Measure)				COMMENTS
	YEAR 1	YEAR 2	YEAR....	OVERALL	
INTENDED					
UNINTENDED					

Worksheet 8.3 has been developed to help you summarize your nonmonetary outcomes. The worksheet allows you to summarize outcomes year by year or at the end of the project (overall). If you present an overall outcome, it is a good idea to indicate the number of years over which the outcome occurs. As usual, the worksheet also leaves a column in which to comment on the indicators. There you should record any weaknesses in measurement which may bias the results of future analyses.

> Use Worksheet 8.3, Summary of Nonmonetary Outcomes, to list indicators of effectiveness and to comment on their limitations.

D. MAKE APPROPRIATE ADJUSTMENTS

At the end of Step 3 we went through the procedures of adjusting cost figures to account for time and other factors. Monetary values associated with outcomes should also be adjusted for time factors. Measured outcomes which span a period of longer than one year should be adjusted for inflation so that the real value of the outcome can be assessed. Inflation adjustments should employ the use of an official consumer price index according to the methods described in Step 3.

When a question calls for the project costs to be discounted to a certain point in time, the monetary outcome measures should also be discounted to the same point, using the same discount rate. In case the logic and procedures for performing such adjustments need to be reviewed, please turn back to the part of Section C entitled "Adjusting for Time." (See also the hypothetical case study in Appendix E.) Briefly, such adjustments would take account of the fact that benefits received early would be more highly valued than those received later, since early benefits can be put to work generating other kinds of earnings, such as interest from savings accounts. Discounting adjusts the benefits figures for such foregone earnings.

Adjusted values for monetary outcome measures should be recorded on a worksheet similar to that used for costs (see Worksheet 3.2). Once discounting has been completed you have the discounted present value (DPV) of project benefits. These are the values which will be used in cost/benefit analyses according to the procedures described in the next step.

CHECKLIST OF SUBSTEPS AND TASKS FOR VALUING PROJECT OUTCOMES
(STEP 8)

SUBSTEPS	TASKS	COMPLETION DATE
A. Review Final Outcomes	A.1 Review outcomes using Worksheet 8.1 and indicate which can be assigned monetary values.	
B. Assign Monetary Values	B.1 Determine market value of outcome where possible. B.2 Estimate monetary value of outcomes according to stated assumptions.	
C. Summarize Nonmonetary Outcomes	C.1 Bring forward nonmonetary outcomes from previous worksheets. C.2 Make sure that such outcomes summarize change due to the project in quantitative terms.	
D. Make Appropriate Adjustments	D.1 Adjust for inflation outcomes covering more than one year. D.2 Calculate discounted present value when appropriate.	

SECTION D

STEP 9

RELATE PROJECT COSTS AND OUTCOMES

Economic analysis of the returns of investment in various projects is based on a comparison of cost and outcomes of each project. The previous steps describing and valuing project resource costs and outcomes have considered project costs and outcomes separately. Consequently, although we have gained many insights into the organization and effectiveness of project activities, we have not been able to make judgments about the profitability of NFE project alternatives. Now that these costs and outcomes have been carefully documented and assessed, we have the basis for systematically relating this information to decision-making needs.

Depending on the nature of the NFE project and the characteristics of available data there are a number of techniques which can be used to relate project costs and outcomes. The main consideration is the extent to which important project costs and outcomes can be measured and valued in monetary terms. In those projects in which monetary values can be assigned to major costs and benefits, it is possible to calculate indexes of their relative profitability. The "benefit/cost ratio," the "net present value" and the "internal rate of return" are the most commonly applied indexes. In those projects where major outcomes or costs cannot be expressed in monetary terms, the use of these indexes is not possible. The evaluator should then employ other techniques such as cost/effectiveness analysis which explicitly brings the nonmonetary aspects of the project into the assessment of the project's merits.

In this step we will introduce various techniques for relating costs and outcomes according to the following sequence:

A. RELATE MONETARY OUTCOMES TO COSTS
B. RELATE NONMONETARY OUTCOMES TO COSTS
C. ACCOUNT FOR UNINTENDED OUTCOMES

A. RELATE MONETARY OUTCOMES TO COSTS

Before taking up the actual calculations, let us review some of the conditions required for meaningful economic analyses. First, we should be sure that the costs and benefits are expressed in comparable monetary terms. This requires that both costs and benefits be consistently adjusted for inflation and discounted at the same rate to a common point in time. In addition, we should determine whether all of the cost and benefit factors relevant to each specific evaluation question have been recorded. Finally, we should review our notes regarding questionable measures, estimated values, special conditions and important nonmonetary factors in order to be able to interpret our results meaningfully.

Worksheet 9.1 has been designed to assist you in pulling together the total cost and the total benefit figures relevant to your analysis. You should have already summarized and adjusted your project costs on Worksheet 3.2 and your project benefits on Worksheet 8.2. If in your evaluation you want to compare various program options (alternatives), they should all be represented on the worksheet. Relevant costs and benefits should be consistently discounted using the multiple discount rates selected in Step 3. Example 9.1 and accompanying Tables 9.1 and 9.2 show how data can be summarized and used in cost/benefit analysis. Generally only total costs and benefits would be listed (see Worksheet

Example 9.1

A provincial project for the teaching of handicraft skills to low income farmers was launched in two rural villages. According to the project design, two project options were tried out, each for a period of 4 years. In Option A, instruction was spread out during the four years of the project and from the beginning participants marketed their products as they produced them. In Option B, instruction was intensive at the beginning but reduced later on and handicrafts were marketed only after they had reached a high level of design and workmanship, resulting in the fact that most of the products were marketed during the last two years of the project.

The evaluation officer of the project kept careful records of the costs and outcomes of the two project options, projecting outcomes for years within the time horizon not covered by the years of project operations. In preparing his data for analysis he assigned monetary values to relevant project outcomes and then calculated net present values for costs and benefits using multiple discount rates. Since most of his outcomes could be assigned monetary values, he decided to perform a cost/benefit analysis to assess which of the two project options represented the better investment strategy.

Table 9.1 presents the cost and benefit data from his project for the years of project operations. Table 9.2 gives the results of a cost/benefit analysis performed on these data.

Table 9.1

COMPARISON OF BENEFITS AND COSTS OF SKILL TRAINING PROJECT OPTIONS

	Project Costs				Project Benefits			
	Current Dollar Value	Discounted Present Value r = 10%	Discounted Present Value r = 12%	Discounted Present Value r = 15%	Current Dollar Value	Discounted Present Value r = 10%	Discounted Present Value r = 12%	Discounted Present Value r = 15%
Project Option 1								
Year 1	3600	3273	3214	3131	3000	2727	2679	2609
Year 2	4000	3306	3189	3024	4000	3306	3189	3024
Year 3	2200	1653	1566	1447	3000	2254	2135	1973
Year 4	2200	1503	1398	1258	4000	2732	2542	2287
Total	12000	9735	9367	8860	14000	11019	10545	9893
Project Option 2								
Year 1	5500	5000	4911	4783	1000	909	893	870
Year 2	4500	3719	3587	3402	1000	826	797	756
Year 3	1000	751	712	658	5500	4132	3915	3616
Year 4	1000	683	636	572	7000	4781	4449	4003
Total	12000	10153	9846	9415	14500	10648	10054	9245

SCOPE Worksheet 9.1

CURRENT AND DISCOUNTED PRESENT VALUE OF PROJECT COSTS AND BENEFITS

Evaluation Question:

	Total Project Costs				Total Project Benefits			
	Current Dollar Value	Discounted Present Value r = ___	Discounted Present Value r = ___	Discounted Present Value r = ___	Current Dollar Value	Discounted Present Value r =___	Discounted Present Value r = ___	Discounted Present Value r = ___
Project Option 1								
Project Option 2								
Project Option 3								
Project Option ...								

9.1). However, in Table 9.1 costs and benefits are listed by year to show how sensitive analyses are to project phasing. The outcome measures in the table only cover the project years. Although this represents a gross underestimation, it has been done to simplify the example.

Use Worksheet 9.1, Current and Present Discounted Value of Project Costs and Benefits, to bring together cost and benefit data to be used in addressing particular evaluation questions.

Techniques for calculating three commonly used indices of project worth -- the benefit/cost ratio, the project's net present value, and the internal rate of return -- are outlined below. Since the three are all indicators of project profitability, it may not be necessary to compute them all. You should choose the one(s) which will best fill the information needs of the decision-makers. (See Appendix E for a complete cost/benefit analysis.)

1. The benefit/cost ratio*

Calculating a benefit/cost ratio is a very straightforward process. It is simply the discounted present value of project benefits divided by the discounted present value of project costs. Thus:

$$\text{benefit/cost ratio} = \frac{\text{Discounted present value of project benefits}}{\text{Discounted present value of project costs}}$$

---

*The terms here may cause some confusion. Although economists speak of "cost/benefit analysis" (a term used throughout this manual), when they actually do the calculating they like to divide benefits by costs, creating a "benefit/cost ratio." They do this so that projects which are profitable will receive ratio values greater than 1.0.

Table 9.2 Results of Analyses for Skill Training Project

Benefit/Cost Ratio

	Discount Rate			
	r = 0	r = 10%	r = 12%	r = 15%
Project Option A	1.17	1.13[a]	1.12	1.12
Project Option B	1.21	1.05	1.02	.98
Net Present Value (in dollars)				
Project Option A	2000	1284[b]	1178	1033
Project Option B	2500	495	208	-170

---

[a] Calculated: Benefit/Cost ratio $= \dfrac{\text{Total discounted present value of benefits}}{\text{Total discounted present value of costs}}$

$$= \frac{\$11{,}019}{\$\ 9{,}735} = 1.13$$

[b] Calculated: Net present value = Total discounted present value of benefits less Total discounted present value of costs

$$= \begin{array}{r} \$11{,}019 \\ \underline{9{,}735} \\ \$\ 1{,}284 \end{array}$$

A benefit/cost ratio more than 1.0 indicates that the project is a profitable investment at the specific discount rate used in the calculations, while a benefit/cost ratio less than 1.0 means that at that particular discount rate the present value of benefits is less than that of costs. Assuming that all costs and benefits have been included and that the discount rate is realistic, any ratio less than 1 would be a signal for policy makers to look for other investment strategies. More generally, the higher the benefit/cost ratio, the more desirable the economic returns from the project. Thus, the measure not only indicates the profitability of a given option but allows us to compare and rank project options and choose those with the most favorable ratios.

Using the above index, it is possible to calculate benefit/cost ratios for the project in Example 9.1 The results of these calculations, found in Table 9.2, demonstrate the importance of using discounted values. Using current values (r=0), Project Option B appears to be the more profitable one. However, since Project Option B is organized so that a high proportion of its costs come at the beginning and a high proportion of its benefits come at the end, it appears to be less profitable than Project Option A when costs and benefits are discounted at 10 and 12%. In fact, when a 15% discount rate is applied, Project Option B appears to be unprofitable!

Although our example presents a comparative model for cost/benefit analysis (comparing one project option with another), such a model is not necessary for assessing the worth of a project as an investment. A single project option clearly can be analyzed for profitability using a benefit/cost ratio. With a single project option, however, policy makers are not able to determine whether or not a project would be more or less profitable if it were organized in a different way.

2. Net Present Value

Another way to relate project costs to project benefits is to calculate the net present value of a project. Once the discounted present values are determined for total costs and total benefits, calculating the net present value (NPV) simply means subtracting the one from the other. Thus:

Net Present Value = Discounted Present Value of Benefits less Discounted Present Value of Costs

If the NPV is positive, it indicates to policy makers that the project is a worthwhile investment, assuming of course that all project costs and benefits are truly represented and that the discount rate chosen is appropriate. A negative net present value indicates that, at least in financial terms, the project is not worthwhile.

As in the case of the benefit/cost ratio, the net present value is, at least in part, a function of the discount rate applied. Returning to Table 9.2, which presents the results of the NPV calculations for our sample project, it is clear that values which are positive under one discount rate can be negative under another. For example, with Project Option B, the NPV (r=10%) is \$495, while the NPV(r=15%) is -\$170.

The net present value is an absolute rather than a relative measure. Since it reflects project scale, it cannot be used to rank projects or to help policy makers choose among alternatives. However, the amount of wealth generated by projects of various scales may also be a relevant decision-making consideration. In these situations, the net present value index is used in addition to the cost/benefit ratio as evidence of the project's overall value.

3. Internal Rate of Return

It should be increasingly clear that for cost/benefit analysis and for net present value calculations, the discount rate is a crucial factor in demonstrating a project's profitability. If the discount rate were completely arbitrary, an evaluator could try out discount rates until he found one that would show his project in a favorable light. The fact is that the discount rate never is arbitrary, but represents the opportunity cost of committing scarce resources to a particular project instead of investing them in the best alternative.

Accurate discount rates are not easy to determine. If an appropriate discount rate is not available, it is possible to determine the rate at which the present value of costs exactly equals the present value of benefits. The discount rate at this point is called the internal rate of return. Thus:

The Internal Rate of Return = The discount rate at which the present value of benefits is exactly equal to the present value of costs

Calculating the internal rate of return of a project usually involves a trial and error process. The analyst who is interested in studying this process in some detail should consult Gittinger (1972, p. 77).

However, in most cases, the internal rate of return can be estimated by using the following simple steps:

(1) Select a discount rate which represents your best estimate of the project's internal rate of return.

(2) Use this discount rate to calculate the discounted present values (DPV) of project costs and benefits.

(3) If this estimate is too high (the DPV of costs is greater than the DPV of benefits) or too low (the DPV of benefits is greater than the DPV of costs), then estimate another discount rate which is likely to be at the other extreme (too high or too low).

(4) Interpolate between the two extreme rates by making more refined estimates until the DPV of costs equals the DPV of benefits.

B. RELATE NONMONETARY OUTCOMES TO COSTS

Throughout this manual we have stressed the importance of accounting for nonmonetary outcomes even when the evaluation emphasis is exclusively on economic analysis. According to the SCOPE approach, there are two main methods of using nonmonetary outcomes in economic analyses: 1) by supplementing the results of cost/benefit analyses with nonmonetary outcomes and 2) by performing cost/effectiveness analyses, where the effectiveness measure summarizes a nonmonetary outcome.

1. Supplementing the Results of Cost/Benefit Analyses

Before describing ways in which nonmonetary outcomes can be used to supplement cost/benefit analyses, it would be useful for you to summarize the results of your previous analyses and list all of the outcomes not

SCOPE Worksheet 9.2

REVIEW OF COST/BENEFIT ANALYSES AND EXCLUDED OUTCOME MEASURES

Project Name:________________________ Date:__________________

Evaluation Question	Cost/Benefit Index r = ____	 r = ____	Outcomes Not Included in Index Calculation	Comments and Implications

included in the calculation of indexes. Worksheet 9.2 is provided to assist you in consolidating this information.

To keep things in perspective, it is recommended that you list in the first column the evaluation question your analysis is expected to address. In the next column you should list the value of the cost/benefit indices you calculated. In the last next column you should list outcomes of the project which, although important, were not presentable in monetary terms, and thus did not enter the cost/benefit analyses. Finally, you should comment on the implications of not including such outcomes on the overall assessment of project worth. (For example, in most cases where there are numerous nonmonetary outcomes, one might expect the worth of a project to be underestimated by the cost/benefit index.)

Use Worksheet 9.2, Review of Cost/Benefit Analyses and Excluded Outcome Measures, to record the results of your cost/benefit analyses and to indicate the outcomes excluded, their values and implications.

Example 9.2 illustrates how the above worksheet can be used. The critical aspect of this example is that according to the cost/benefit analysis, the project in question is unprofitable. (Note, for example, the NPV's of -$10,000 and -$12,000.) It is the important task of the policy maker, with the help of the evaluator, to decide whether the nonmonetary outcomes described in the right-hand columns are at least worth the net present value of the project. Another way to face this issue is to ask: What value would have to be assigned to the nonmonetary outcomes in order for the project to "break even?" Are the nonmonetary outcomes worth this much?

Example 9.2

REVIEW OF COST/BENEFIT INDEX CALCULATIONS FOR HYPOTHETICAL NFE PROGRAM IN NEW FARM TECHNOLOGIES

Evaluation Question	Cost/Benefit Index		Outcomes Not Included in Index Calculation	Comments and Implications
	r = 10%	r = 15%		
Should this project be repeated in the Northwestern Provinces?	Benefit/Cost Ratio		Farming families are better nourished and in better health 20% fewer sick days in school lower infant mortality rate Children in approximately 50% of the families are allowed to continue schooling to the grade 6 level. (The average for comparable groups is grade 2.)	Work force is not only more productive but contributes toward priority goal of better child care and health The 96 children receiving the education could well be a catalyst for more economic growth and continued adoption of innovations. Cost/benefit index underestimates worth of the project.
	.92	.85		
	Net Present Value			
	-$10,000	-$12,500		

Break-even analysis, which requires the evaluator to decide whether the nonmonetary outcomes add enough to project benefits to make them *at least as valuable as project costs*, is thus one form of supplementary analysis. Break-even analysis assumes that, without the added value of nonmonetary outcomes, the project is unprofitable and that decision makers will be satisfied with a benefit/cost ratio of one (or an NPV of zero -- which is what "breaking even" means).

Nonmonetary outcomes can also be used to supplement cost/benefit analyses when the NPV of the project is positive or, in other words, when the project is already judged profitable. In such a case, the evaluator will attempt to determine whether the nonmonetary outcomes *reinforce* the implications of the cost/benefit analysis or not. For example, if the index value indicates that benefits are greater than costs for the project and the nonmonetary factors are also positive, then we know that the project is even more attractive than originally indicated. If, on the other hand, the nonmonetary outcomes are negative or inconsistent with the monetary benefits, it may be that the project is less attractive than originally indicated. Furthermore, the "reinforcement value" of nonmonetary outcomes can be used when comparing alternative projects, especially when the cost/benefit analyses do not point to any clear choices.

These techniques are admittedly subjective, but it is undoubtedly better to enter nonmonetary outcomes in these ways than to leave them completely out of the picture. In the following paragraphs, we will go on to describe how nonmonetary outcomes can be used by themselves in the analytically more rigorous procedure of cost/effectiveness analysis.

2. Cost/Effectiveness Analysis

In the cost/effectiveness framework, the project's cost ingredients are compared with available evidence that the project's main objectives and intended benefits have been attained. While this approach does not result in precise ratings of the profitability of the project, it does provide a realistic basis for decisions concerning project selection and investment soundness.

The general approach in cost/effectiveness analysis is to compare the costs of a project with the measures of project effectiveness, asking the question: Were the outcomes worth the costs? Since nonmonetary outcomes cannot be summarized into a single summary measure like monetary outcomes can (except through the use of some very complex scaling procedures), it is best just to present a list of such outcomes to be compared with costs.

In some cases, where a number of project options are being compared on a single principal outcome measure, it makes sense to calculate a cost/effectiveness ratio as follows,

$$\boxed{\text{cost/effectiveness ratio} = \frac{\text{project costs}}{\text{effectiveness measure}}}$$

Using this ratio in comparing various options, the evaluator can indicate which represents the best alternative. The best alternative, as we shall see in Example 9.3 is *not* necessarily the least expensive one, nor is it necessarily the most effective one. It is, in fact, the one which minimizes the cost per unit (or per unit change) of the effectiveness measure. In other words, it is the most *cost-effective* alternative.

Example 9.3

The National Health Ministry of Swatland has set a high priority on reducing the incidence of a particular bacterial disease among the preschool children in the Northeastern province. Under ministerial directive, the Public Health Education Unit of the ministry has funded and operated a project to teach rural families better sanitation, nutrition and health care practices. Four project options were set up in comparable villages in the province, using alternative project delivery systems. A fifth location, a village much like the others, was chosen as a control site.

The Project Evaluation Team, which was created before actual implementation began, collected appropriate baseline information concerning disease incidence in each village during the year prior to the project. During the project implementation year, the team monitored records on project costs and recorded disease incidence. By subtracting the end of project level of incidence from the baseline level the team determined the number of percentage points the incidence of disease had changed after a year of project operations. This change figure is the effectiveness measure or the project. A summary of the team's cost/effectiveness analysis is shown in Table 9.3.

Table 9.3 Cost/Effectiveness Summary for Community Disease Reduction Project

Project Option	Project Cost Per Inhabitant	Outcome Measure (Yearly Incidence of Disease)		Effectiveness Measure (Change in Incidence)	Cost/ Effectiveness Ratio	Comments
		Baseline	End of Project			
		(a)	(b)	(a-b)		
PO 1	$ .60	18%	16%	2%	.30	Least costly option
PO 2	$ .90	17%	12%	5%	.18	Most cost-effective option
PO 3	$ .82	15%	14%	1%	.82	Least cost-effective option
PO 4	$3.60	20%	11%	9%	.40	Most effective option

Table 9.3 illustrates a number of interesting features about the project described in Example 9.3. For example, Project Option 1 (PO1) appears as the least expensive option, while Project Option 4 (PO4) appears as the most effective (see column 4 "Effectiveness measure"). In cost/effectiveness terms, however, PO2 is the leader, and, *other things being equal*, would probably be the alternative chosen by policy makers.

The extent to which *other things are not equal* should be carefully examined before the results of your analyses are transformed into policy recommendations. This requires that you pay careful attention to the contextual factors which you have recorded on your worksheets. It also makes a strong case for including a comparison group in your design, since this is the best way of determining whether the changes you observe are due to the NFE project or to some external factor.

Cost/effectiveness analyses can also be made by simply comparing the per student costs of programs whose participants have attained the same level of proficiency. For example, if a Grade 2 literacy level can be achieved by comparable illiterate adult populations in rural areas using either a radio learning project or a more conventional classroom approach and the cost per student is $250 and $380 respectively under the two systems, then the first project is the most cost-effective way of achieving this objective. Such a technique can also be used in projects relating to public health, community development and other areas where the objective is to reach a predetermined target.

Worksheet 9.3 has been designed to assist you in organizing your cost/effectiveness analyses. Since the format of the worksheet is

SCOPE Worksheet 9.3

CALCULATING COST/EFFECTIVENESS RATIOS

Project Name: ______________________________ Date: ____________________

Project Option	Project Cost	Outcome Measure		Effectiveness Measure	Cost/Effectiveness Ratio	Comments
		Baseline	End of Project			

identical to that of Table 9.3, which has already been described, there is no need to go over the worksheet in detail. Remember to include all project options and to comment on any important contextual factors.

> Use Worksheet 9.3, Calculating Cost/Effectiveness Ratios, for performing cost/effectiveness analyses and recording important qualifying information.

C. ACCOUNT FOR UNINTENDED OUTCOMES

So far, the discussion of methods for relating project costs and outcomes has not explicitly distinguished intended from unintended outcomes. The cost/benefit analyses used a single summary benefits term while the cost/effectiveness framework focused on the question of whether the project accomplishes its stated objectives at a reasonable cost. Once these initial assessments have been carried out, the effects of unintended outcomes should be brought into the analysis. They may affect not only the decision maker's overall assessment of the worthiness of the project, but can also provide guidance for the design and operation of similar projects.

If significant unintended outcomes have been listed on the worksheets of Steps 7 and 8, the analyst should now explicitly bring them into the evaluation. Where cost/benefit analyses are used, the unintended outcomes which can be assigned monetary values should be incorporated into benefit/cost ratios and net present value measures by adding them (if positive) or subtracting them (if negative) from existing benefits terms. The difference between the cost/benefit index before and after adjustment for unintended outcomes should illustrate the effect of such outcomes on project profitability. If the unintended outcome is judged to be socially significant, then the adjusted index is the one which should be presented to policy makers. Unintended outcomes of the nonmonetary variety can be brought into consideration in the same ways as other nonmonetary outcomes, either in break-even analysis, or to reinforce previous findings, or as an adjustment to cost/effectiveness analyses.

CHECKLIST OF SUBSTEPS AND TASKS FOR RELATING PROJECT COSTS AND OUTCOMES
(STEP 9)

SUBSTEPS	TASKS	COMPLETION DATE
A. Relate Monetary Outcomes to Costs	A.1 Bring together discounted value for project costs and benefits	
	A.2 Perform cost/benefit analyses, calculating benefit/cost ratios, net present values or internal rates of return	
B. Relate Nonmonetary Outcomes to Costs	B.1 Summarize the results of cost/benefit analyses and indicate the outcomes excluded	
	B.2 Use nonmonetary outcomes in supplementing the results of cost/benefit analyses	
	B.3 Use nonmonetary outcomes in cost/effectiveness analyses	
C. Account for Unintended Outcomes	C.1 Review unintended outcomes	
	C.2 Incorporate those with monetary values into cost/benefit analyses	
	C.3 Introduce those with nonmonetary values into analyses according to procedures used in B.2 and B.3.	

SECTION D

STEP 10

INTERPRET THE RESULTS OF THE ANALYSIS

If you have followed the SCOPE method step by step to this point, you may be asking yourself, "How can I possibly trust the results of my analyses, given the fact that so many values were estimated under shaky assumptions?" The fact is that there are ways of working with even the most unreliable of data in order to arrive at some conclusions about the worth of an NFE project. The passages which follow present ways in which you can work with error-ridden data. They demonstrate methods of testing whether the errors in your data will seriously bias your conclusions. They show you how you can strengthen your presentation of results by making explicit allowances for probable errors. They indicate how you can develop a range of possible conclusions which corresponds with a range of probable errors. In other words, this step indicates ways in which you can work with measurement and estimation errors, instead of burying them to be discovered (perhaps) by others later on. At the end of this step we will illustrate ways to interpret analysis results and discuss how economic analysis is only one of many tools an administrator can use to shape policy decisions.

A. REVIEW THE QUALITY OF YOUR DATA

On numerous occasions during the course of your work you have recorded observations and comments concerning the limitations of your estimates and assumptions. (See Worksheets 3.1, 5.2, 6.2, 7.4, and 8.2.) Now it is time to carefully review the specific areas in which you suspect that data errors or unrealistic assumptions may have occurred. Since economic analysis of NFE projects always depends upon assumptions and estimates of the true value and timing of cost and benefit items, you are bound to have come across a variety of problems. However, not all of these problems will have major impacts on your overall conclusions regarding cost/outcome relationships. As we consider simple methods for determining the impacts of errors on final analyses, you need only select those cost or outcome items which in your estimation present the most serious threat to the validity of your conclusions.

The extent to which an analysis or conclusion is influenced by errors in measurement or estimation is often referred to as the analysis' or the conclusion's "sensitivity" to errors. The sensitivity of the earlier evaluation conclusions to an error (or errors) will depend upon:

1. the size and direction of the error(s),
2. the importance of the variable(s) affected by the error(s),
3. the likelihood of the error(s),
4. the circumstances under which the error(s) occur.

Problems or errors which are judged to have potentially important impacts on evaluation conclusions can be described in a manner suggested by the first three columns of Worksheet 10.1.

Some of the errors you might have chosen to examine can be expressed in quantitative terms and some cannot. We shall first consider a procedure for determining the "sensitivity" of project conclusions to quantifiable

SCOPE Worksheet 10.1

REVIEW OF PROBLEMS RELATING TO COST AND OUTCOME DATA

Problems Identified	Cost(s) or Outcome(s) Affected	Direction of Error	Magnitude of Error	Implications for Evaluation Results

errors. The logic behind this procedure is then extended to errors expressed in nonquantitative terms.

B. DETERMINE THE IMPACT OF QUANTIFIABLE ERRORS ON THE OVERALL EVALUATION

The procedure described here can be used to answer the following questions related to project evaluation:

> By what amount might the original cost or outcome estimate be in error?
>
> How sensitive will the evaluation conclusions be to an error of this size?

The procedure includes the recalculation of the cost/benefit or cost/effectiveness ratios calculated in Step 9, using cost and outcome values adjusted by the amount of the identified error. The steps in this process are outlined below:

1. Calculate a range of values for the cost or outcome in question. Once the direction and magnitude of the error is determined, the analyst can use the information to calculate high and low boundary values for the cost or outcome component. For example, if it is thought that salaries may be underestimated by as much as 20%, a high estimate of salaries would be 120% of the original value and a low estimate would be the original value itself.
2. Recalculate cost/benefit and cost/effectiveness indexes using the new values. Our major concern at this point is whether the project remains as economically sound (or

unsound) as our original calculations in Setp 9 indicated. For example, in the case of cost/benefit analysis, we would want to know if the benefit/cost ratio remains greater than (or less than) 1.0 even when the high and low cost or benefit values are used in the calculations.

3. Consider the implications of these new calculations.

If the same conclusion about the project's profitability or cost/effectiveness is indicated using the more extreme cost and/or benefit values (e.g., all the benefit/cost ratios are greater than 1.0), the sensitivity analysis tends to strengthen the original results from Step 9. The analyst can then, in presenting his or her results, point out that the conclusions regarding a project's economic worth remain the same even allowing for a specified level of error.

If by using the new range of values in the cost/benefit or cost/effectiveness analyses the conclusions do not confirm those arrived at earlier, the analyst must carefully explore the impact of these errors in light of other information about the project. For example, the analyst could review the nonmonetary outcomes which were identified in Step 9 and their relation to the cost/benefit calculations. In particular he/she could ask:

> Are the nonmonetary outcomes of sufficient importance to offset the effects of the specific errors in measured or estimated values in our earlier evaluation of the project's merits?

Finally, the analyst must indicate how likely specified data errors are to occur and under what circumstances. Such information would allow decision makers to decide how serious a threat certain errors are to project conclusions (for instance, errors that occur under rare circumstances may not be as serious as those which are common). This information could also signal to evaluators how to avoid similar errors in the future.

An exercise in the use of the above procedures is presented in Example 10.1. In the example, suppose that there is considerable uncertainty about the exact amount by which the NFE program will increase crop yields. Not only are weather, other environmental conditions, and supporting government policies uncertain but there is some uncertainty as to how faithfully the participants will apply the skills and knowledge they acquired in the program. The participants' stated intentions and their behavior in the beginning of the first year after the training program would indicate crop yield increases of 70%. On the other hand, if the central government does not continue subsidies of the fertilizers required in growing the new crop strains, farm yields might well increase by only 30%.

These potential errors set upper and lower bounds on program benefits which in turn affect assessments of the project's profitability (Table 10.2). The discounted present value of benefits now ranges from $150,900, using an 8% rate of discounting and high crop yield estimates, to $90,900, using the lower crop yield estimates and a 15% discount rate. As Table 10.3 shows, benefit/cost calculations are affected by these different estimates of crop yield increases due to the program.

Example 10.1

A one year NFE project training local farmers in the use of new crop and fertilizer technologies is estimated to increase crop yields by 50% each year for 5 years following the program. (It is assumed that these technologies will be obsolete after this 5-year period and will, at that time, be replaced by more advanced agricultural strategies.

The original cost and benefit values used in evaluating the project are shown in Table 1.

Table 10.1

Costs and Benefits of Illustrative NFE Project

	Benefits				Costs			
Year	Current Value	Discounted Present Value			Current Value	Discounted Present Value		
		r=8%	r=12%	r=15%		r=8%	r=12%	r=15%
1					$ 70,000	$ 64,800	$ 62,500	$60,900
2	$ 36,000	$ 30,900	$ 28,700	$27,200	15,000	12,900	12,000	11,300
3	36,000	28,600	25,600	23,700	15,000	11,900	10,700	9,900
4	36,000	26,500	22,900	20,600	15,000	11,000	9,500	8,600
5	36,000	24,500	20,400	17,900	15,000	10,200	8,500	7,500
6	36,000	22,700	18,200	15,600	15,000	9,500	7,600	6,500
otal	$180,000	$133,200	$115,800	$105,000	$145,000	$120,300	$110,800	$104,700

Table 10.2

Range of Project Benefits in Illustrative NFE Project

	Yields Increase by 70%				Yields Increase by 30%			
Year	Current Value	Discounted Present Value			Current Value	Discounted Present Value		
		r=8%	r=12%	r=15%		r=8%	r=12%	r=15%
1								
2	$ 40,800	$ 35,000	$ 32,500	$ 30,800	$ 31,200	$ 26,700	$ 24,900	$ 23,600
3	40,800	32,400	29,000	26,800	31,200	24,800	22,200	20,500
4	40,800	30,000	25,900	23,300	31,200	22,900	19,800	17,800
5	40,800	27,800	23,100	20,300	31,200	21,200	17,700	15,500
6	40,800	25,700	20,700	17,600	31,200	19,700	15,800	13,500
Total	$204,000	$150,900	$131,200	$118,800	$156,000	$115,300	$100,400	$ 90,900

Table 10.3

Range of Cost/Benefit Index Values for Illustrative NFE Project

	Benefit/Cost Ratio			Net DPV		
Estimated increase in Crop Yields	r=8%	r=12%	r=15%	r=8%	r=12%	r=15%
70%	1.25	1.18	1.13	30,600	20,400	14,100
50%	1.11	1.04	1.00	12,900	5,000	300
30%	.96	.91	.87	-5,000	-10,400	-13,800

Although the discussion of sensitivity analysis has so far focused on possible errors in estimating costs and benefits, sensitivity analysis can be applied to any other kind project factor. One variation of sensitivity analysis involves the use of multiple discount rates in cost/benefit calculations. In Table 9.2 in Step 9, the use of a 15% discount rate resulted in an assessment of negative project profitability while the same calculations using a 10% rate indicated positive returns to the sample project. Similarly, in Example 10.1, the highest discount rate (15%) brought the original benefit/cost ratio down to 1.0.

C. DETERMINE THE IMPACT OF NON-QUANTIFIABLE ERRORS

It is often the case that many important potential errors in original analyses cannot be examined using quantitative methods. Either the error itself is not of a quantitative nature (as in an erroneous assumption about project conditions) or the evaluation component (generally an outcome) which is poorly estimated is itself nonquantifiable. Despite their nonquantifiable nature, these potential sources of error should be examined in as systematic a manner as possible. The approach to weighing the impact of such errors is similar to that of quantifiable errors. The major difference is that in the case of the former, estimates will be rougher and will be based on more subjective criteria.

After potential errors have been identified and described in as precise a manner as possible, you need first to determine whether the occurrance of an error in a particular item is likely to work in favor of the conclusion reached in Step 9 or against it. For each suspected error ask yourself:

a. Was my estimate probably too high or too low?

b. Will the error strengthen or weaken my overall conclusion about cost/outcome relationship?

If, after the review, you decide that the error is likely to work in favor of your conclusion, you need simply to point out in your report that your estimate is a conservative one and that there is some possibility that the results may be stronger than you have indicated. If, on the other hand, you decide that the error may work against your conclusions you should consider whether its impact is likely to be of sufficient importance to alter your ultimate conclusions. Here you should note that the significance of the potential error depends not only upon its size but also upon the priority given to the economic and social factors which it affects, and the conditions under which the error is likely to occur.

Use Worksheet 10.1, Review of Problems Concerning Outcome and Cost Information, to analyze the impact of suspected errors on your overall project conclusions. Identify suspected errors in quantitative and non-quantitative items, indicate the direction of the error, the likely magnitude of error, and the probable implications for evaluation results.

D. INTERPRET YOUR OVERALL RESULTS

1. Explaining the Results

The primary focus in an economic evaluation is the comparison of the economic costs and outcomes of a project. However, it is also important to understand the process by which the results occurred as they did. By identifying the factors which have contributed to a program's success or failure, you have a reasonable basis for suggesting program modifications to cope with changing conditions and for recommending ways of improving future NFE planning.

Steps 5,6, and 7 identify several categories of variables which can significantly affect the costs and outcomes of a project. These include the structure and organization of the project, characteristics of the participants, social and environmental characteristics of the local community, and national level development policies and practices. In determining the importance of such "explanatory" variables, you should ask:

> Did the occurrence of this factor enable the project to be set-up and operated at a signficiantly lower cost than otherwise would have been possible? (For example, the presence of a good road system might reduce the costs of transporting students to the project site.)
>
> Did the occurrence of the factor contribute to the achievement of the measured level of educational, economic, or social change? (For example, a better educated project population may be more likely to understand and implement the health practices recommended.)

By going beyond the typical cost/benefit, cost/effectiveness approach and diagnosing the results of your evaluations in this fashion, you are in a position to advise policy makers on a broader range of questions involving NFE projects.

2. Reaching a Final Appraisal of the Project's Value

This manual has been mainly concerned with economic analysis. Our attention has been focused on whether or not a particular project is worthwhile from an economic perspective. Yet, as we noted at the very start of our discussion, economic analysis in and of itself has limitations as an approach to decision-making in the educational sector.

We have tried to temper our quantitative analysis by building in ways of accomodating costs and outcomes which are nonmonetary and hard to measure. However, there may be considerations, particularly political and humanitarian ones, which are so vital that they can often override the conclusions of our analyses. As the last task in the evaluation, you should review your conclusions in light of the major social and political goals explicitly or implicitly set for the project, paying attention to the side effects which the project may have produced.

The final appraisal of the value of the NFE project will be made by policy-makers, planners, and administrators based on a host of important considerations. It is the job of the evaluator to clarify the issues, to provide sound information, and to interpret the results in a way that will yield an appropriate guide for policy and program choices.

CHECKLIST OF SUBSTEPS AND TASKS FOR INTERPRETING THE RESULTS OF THE INVESTIGATION (STEP 10)

SUBSTEPS	TASKS	COMPLETION DATE
A. Review the quality of the data	A.1 Review areas in which you suspect errors have occurred. A.2 Select cost or outcome items, which present the most serious problems, for further analysis.	
B. Determine the impact of qualitative errors	B.1 Calculate a range of possible values for the variable in question. B.2 Recalculate the outcome/cost relationship using the new values. B.3 Consider the implications of the new calculations on the assessment of the project's profitability.	
C. Determine the impact of non-quantifiable errors	C.1 Determine the direction of impact. C.2 Determine the significance of impact. C.3 Provide a description of conditions under which major errors are likely to occur.	
D. Diagnose the results	D.1 Explain why the results occurred as they did. D.2 Review the results in light of major non-economic considerations.	

SECTION E1

REPORT WRITING

No matter how much effort goes into project evaluation, it can be a worthless exercise unless people understand and use the findings. The importance of producing functional evaluation reports cannot be emphasized enough. In order to be effective tools for taking appropriate action, such evaluation reports must present information which is relevant to decision-making needs. In other words, they must provide information to answer the questions to which the investigation was directed.

If evaluation reports are to be understood, the language in which they are written must be appropriate to the background of the report recipients, and statistical data must be clearly stated, perhaps in simple charts and graphs. Reporting must also be sensitive to (although not avoid or distort) relevant political issues. This means that when interpreting project results, the evaluator should take into consideration the problems of the individuals or groups involved.

In addition to communicating data clearly, evaluation reports should communicate data when needed. If reporting is not timely, the information becomes less useful. In Section D, Step 1, we discussed a reporting timeline which can allow the investigator to pace his or her activities according to the total amount of time designated for the project assessment. The information provided in interim reports serves as an excellent basis for writing the final report. If you do not write interim reports, however, you might consider drafting your final report several weeks before the end of the evaluation. This helps you to determine what information you still need, and where to concentrate your evaluation activities in the remaining time.

As your findings will most likely be directed to busy administrators, be sure your data are as concise and streamlined as possible. Brevity is the key to having reports read. However, this does not imply that you should not provide sufficient information to indicate the validity and reliability of your results. A simple method for providing information which is quickly digestable yet sufficiently detailed is to separate your report into two major sections: a brief and sharp summary, and a longer, more detailed account of the investigation.

The summary should include a simple statement of the purpose of the investigation, a brief description of the manner in which the project was evaluated, a clear statement of the findings, and, if appropriate, a list of recommendations for administrative action. All of this information can be presented in a few pages at the beginning of your report. The second section should also be simple and direct, but should elaborate upon the evaluation format and the findings in greater detail. Below is a suggested outline for writing a final cost/effectiveness or cost/benefit project evaluation report.

I. SUMMARY

  A. Purpose of investigation
  B. Method of investigation
  C. Findings
  D. Recommendations

II. COMPREHENSIVE REPORT

  A. Background of investigation (purpose of investigation, audience to whom report addressed, identity of investigators, length of investigation, questions to be addressed)

  B. Goals and objectives of the NFE project

  C. Description of the project (history and strategy, elements and activities, management framework, links with other development activities

D. Method of investigation

  1. Approach to costing (selection of resources to be costed, determination of prices)
  2. Approach to assessing outcomes (selection of indicators, design, data collection techniques, analysis techniques)

E. Findings (cost, outcomes, relation of cost to both intended and unintended outcomes)

F. Limitations of findings

G. Analysis of results

H. Recommendations for administrative action

Samples of data collection instruments, short case studies, technical discussions, and whatever additional information you feel may be of interest to the intended recipients may be presented in an appendix to the report.

Obviously, you can use a variety of reporting formats to present your data. What is most important is that the report be understandable to its audience and that the information be on hand when it is needed.

Ideally, the final evaluation report should be reviewed by members of the project staff and others involved in the project evaluation before wider distribution. Such a review may uncover errors in the report contents and can serve to inform the field level management of the project. It is also very important that the evaluation results and diagnosis of results be shared with project participants and members of the target group or community. Popular participation in the development process, a major goal of NFE, requires that the populace be informed about the overall effectiveness of the project activities in which they invest their time, money and physical resources.

SECTION E2

INFORMATION PROCESSING

A. NEED FOR INFORMATION

Information in connection with NFE programs is needed for two primary purposes. First, in evaluating a proposed program, it is useful to have information about past programs that can help in estimating the likely results of the new program. For example, information about past training programs will be helpful in estimating such costs as the cost of living accommodations for students, instructors, and classroom space. Second, information about the expected results of an existing program, compared to the actual results achieved, is necessary if any control is to be achieved. Without such control to measure the gap between plans and accomplishments, a program is very likely to give disappointing results.

If information is to be available for these two purposes -- evaluation of proposed programs and control of existing programs -- it is necessary to provide a means for collecting, storing, and retrieving data about programs. Many approaches are possible for processing such data, from informal manual methods to computer-based automated methods. The cost and effort involved in designing and operating the information system must be carefully considered in order to get a suitable balance between the cost of the system and the value of the information obtained from it.

B. WHAT IS A DATABASE?

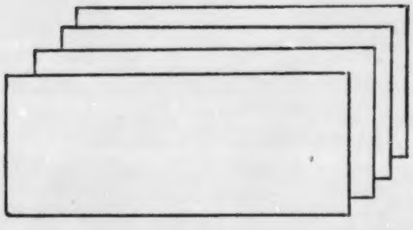
The information of concern to NFE analysts should be stored in a "database" (Figure 1). A database is an organized collection of data from which useful information can be retrieved. The data may be stored

Figure 1

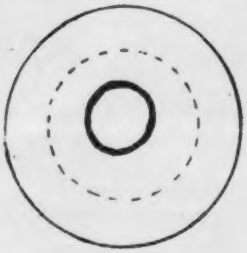
A "database" is an organized collection of data from which useful information can be obtained.

Examples:

- Names of participants in NFE programs
- Facilities available for classroom instruction
- Costs of various resources used in NFE programs



A database stored on index cards



A database stored on a magnetic disk

in a number of different forms -- in paper files, on file cards, or in a computer-based system. Although information systems vary widely in terms of their size and degree of automation, their basic operation and underlying principles are much the same.

A database consists of *records* about people or things. For example, the system may maintain a record about each student and instructor who has participated in an NFE program. Each program may also have a record within the system to store such information as its participants, its beginning and ending dates, its budget for each time period, and its latest status.

A collection of records of a given type is called a *file*. For example, the collection of records pertaining to students constitutes the student file, the collection of records about programs constitutes the program file, and so forth.

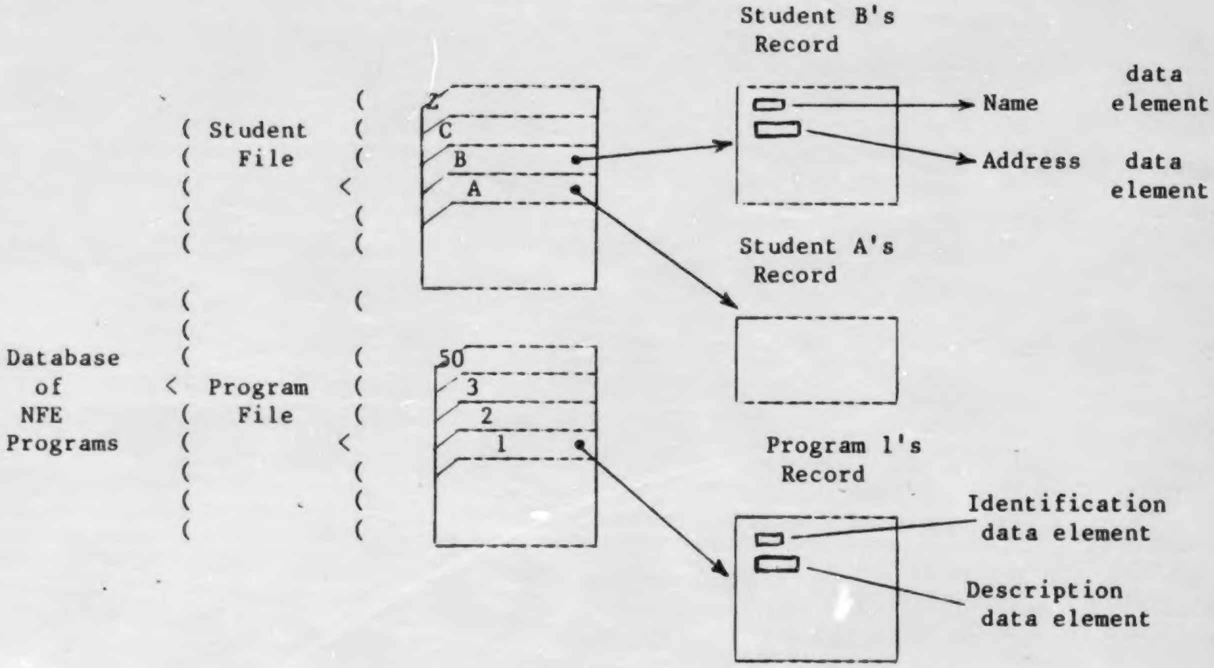
A record consists of various *data elements* (also called *fields*). A data element gives detailed data about the person or thing described in the record. For example, a student record would normally contain such data elements as the student's name, address, date of birth, training received, evaluation, and the like.

Figure 2 shows the relationship between files, records, and data elements.

C. USE OF THE DATABASE

The database provides the primary source of information available to planners, program managers, government officials, and other users of information about NFE programs. Other sources of information exist, of course -- personal inspections, recollections, common

Figure 2


Student B's Record
data element
Name
Address
data element
Student File
C
B
A
Student A's Record
Database of NFE Programs
Program File
50
3
2
1
Program 1's Record
Identification data element
Description data element

Relation Among Files, Records, and Data Elements Within the NFE Database knowledge, and the like -- but the formal system generally provides a more reliable and permanent source of needed information.

Three steps are involved in the processing of the database, as shown in figure 3.

1) Collecting the Data. Data are generally collected when an event occurs that is important enough to justify recording information about it. When a farmer begins a training program, for example, his name, address, date of birth, and other personal data are generally recorded on some formal record. Whenever a new event occurs pertaining to this student, the record is updated to reflect the change -- such as a visit by an agricultural agent or the measurement of the farmer's output for a given crop and fertilizer treatment.

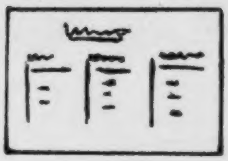
2) Storing the Data. The collected data are retained on some form of storage medium. Often the storage medium is simply a paper form on which space is assigned to each data element. Data are entered on the form by writing them in the appropriate spaces. This simple system is often perfectly satisfactory for many purposes. In larger systems, the data may be recorded on a storage medium that permits further machine processing of the data, such as punched cards or magnetic tape.

(3) Retrieving the Data. When information is wanted from the system, it must be retrieved from the database. If the need for information is only a matter of getting a given fact from a record in the database -- the address of a former student, for example -- paper records are often quite adequate. In

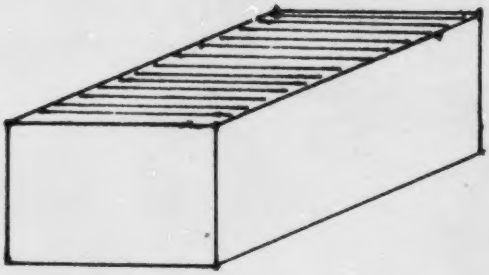
Figure 3

Steps in Using a Database

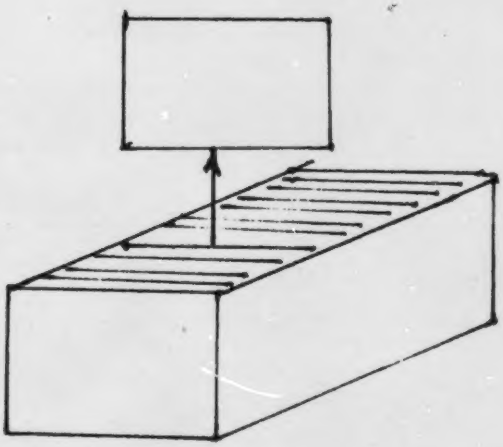
Collecting the data:



Storing the data:



Retrieving the data:



this simple example, if student records are arranged alphabetically by name, one can easily find a student's address by retrieving the student's records from the student file.

If the request for information is more complex, however, the system of paper records is much less convenient. Suppose, for example, it was desired to find the average wage rate of all students who completed a given kind of training more than three years ago. This would require a look at each record in the student file to see if a student a) had received the specified training, and b) completed it over three years ago. For those students meeting these two conditions, their current wage rates (which are presumed to be updated periodically to keep them current) are accumulated in order to calculate an average. If the number of records in the database is fairly small, a manual search may be feasible; if, however, the number of records gets above a few hundred, then more automated systems become very advantageous.

D. ORGANIZATION OF THE DATABASE.

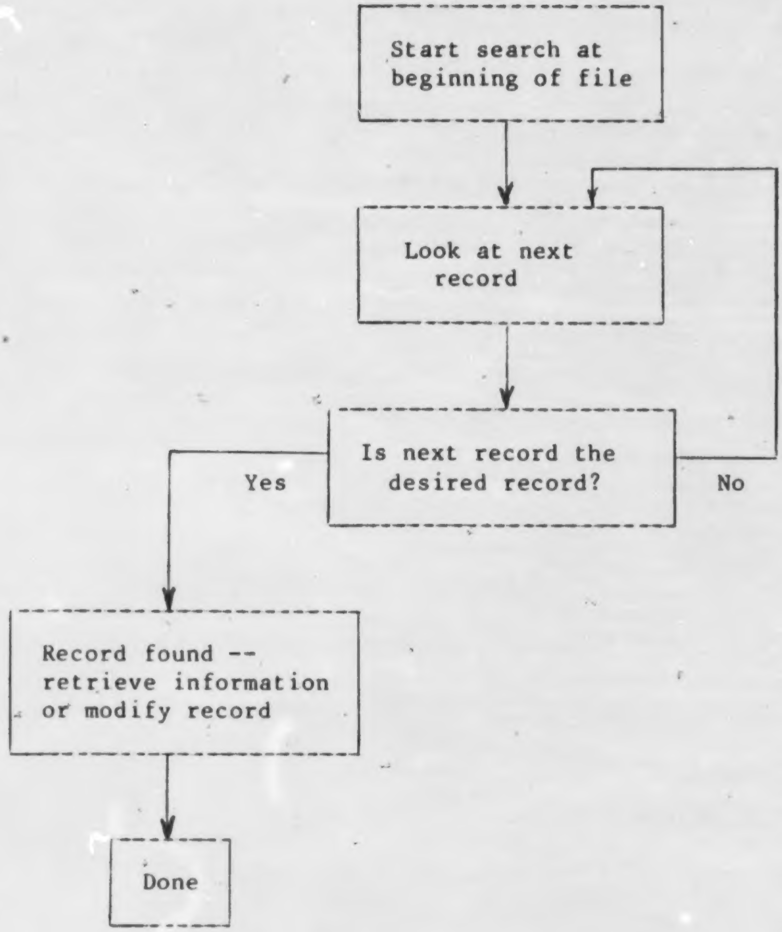
The organization of a database deals with the way in which files, records, and data elements are physically arranged. A database's organization has a major effect on its use for storing and retrieving information.

The simplest file structure is a sequential organization. Records in such a file are arranged in numerical or alphabetical sequence, and all access is strictly in such sequence. For example, student records might be arranged in ascending alphabetical sequence of each student's name. Any attempt to obtain information about a given student, or to modify the student's record, would require looking at each record in its proper sequential order until the desired record is found. The flow diagram, Figure 4 shows (in simplified form) the search logic used.

Such a search appears unnecessily complicated and time consuming. Indeed, in a manual system in which a person could skip over records, it would certainly be possible to locate a given record more rapidly than would be possible with a sequential search. In some automated systems, however, the records are kept in a storage medium that does not permit skipping of records. For example, each record may be kept on a single punched card; the student file would then consist of a deck of such cards, with the cards arranged into alphabetical sequence. A "card reader" can be used to "read" information punched into each card (for processing by a computer, say), but the reader can read only one card at a time sequentially from the bottom (or top) of the deck of cards. The cards would thus be read in this way until the desired record was found (or, if the record was not in the file, the sequence in the file was reached where the record would have been found if it were included in the file).

Magnetic tape is another data storage medium that can inherently only be read sequentially, because the reading device must pass over the beginning of the tape before it can get to later records -- just as in the case of music recorded on a cassette tape, in which the first part of the music must be heard before later portions. Although some audio tape players allow the listener to pass over unwanted

Figure 4


Start search at beginning of file
Look at next record
Is next record the desired record?
Yes
No
Record found -- retrieve information or modify record
Done

A simple search of a sequential file.

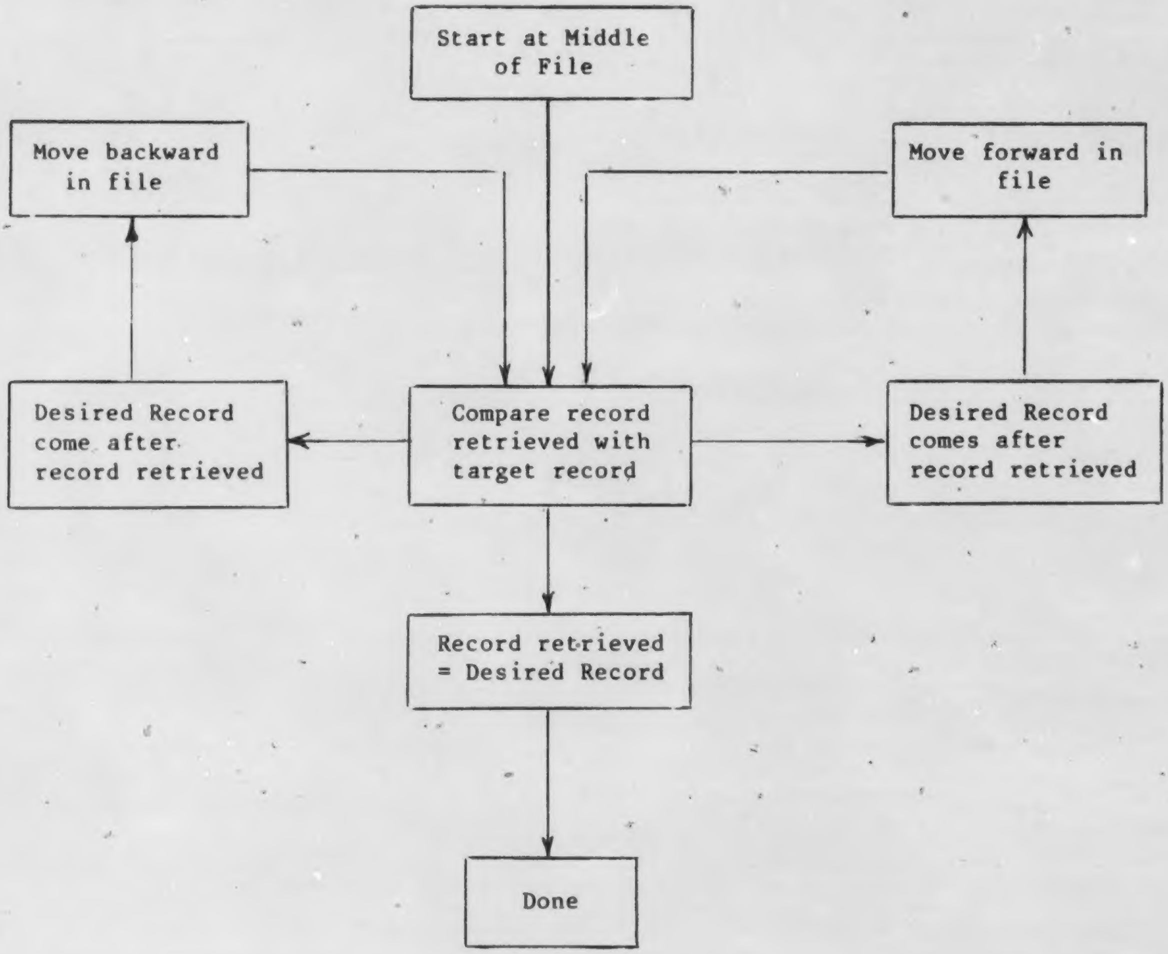
portions at a higher than normal speed, this is not possible in the case of data records because each record must be read in order to determine if it is the desired record.

The fundamental charcteristic of a sequential storage medium is the need to read each record in its normal sequence until the target record is found. This is not required when a direct access storage medium is used; in this case, it is possible to go (more or less) directly to the target record without reading all intervening records. In many situations this can be of substantial advantage.

Consider again the case of a manual system for locating a student record that is written on a an index card and arranged alphabetically within the file. A clerk wishing to locate the record of a student named "RODRIGUEZ" would not have to start searching at the beginning of the file, but should instead start about three quarters of the way through the file (since the letter "R" is about three quarters of the way through the alphabet). If the name on the first record retrieved came before RODRIGUEZ in the alphabet (e.g., PATEL), the next record compared should follow further in the file; if the name came after RODRIGUEZ (e.g., SANCHES), the next probe should be earlier in the file. The record (if it is in the file) would eventually be found through a back-and-forth search, with the distance between records being narrowed as the search converges on the name RODRIGUEZ. We are all, of course, familiar with such a search strategy, and employ it informally whenever we have to locate a specific item in a sequential list of items (such a word in a dictionary or a name in a telephone directory). The flow diagram (Figure 5) shows the basic logic of such a search.

Figure 5

A Direct Access Search at the Database


Start at Middle of File
Move backward in file
Move forward in file
Desired Record come after record retrieved
Compare record retrieved with target record
Desired Record comes after record retrieved
Record retrieved = Desired Record
Done

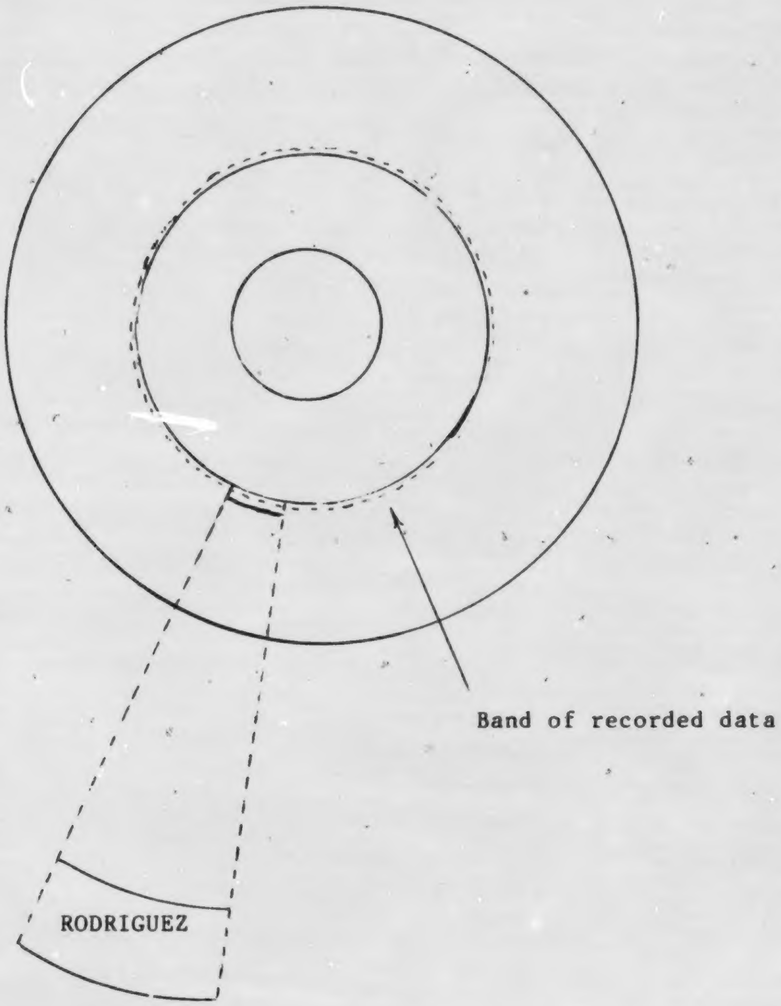
A non-sequential search is efficient in most manual systems, because a human can usually directly retrieve a record from the file rather than having to scan each record sequentially. In an automated retrieval system, a non-sequential search is possible if the storage medium allows direct as well as sequential access to records. The most common device that allows direct access is a magnetic disk storage unit. In this device, information is stored in concentric bands on the surface of a revolving disk (not a spiral band as in a phonograph record). Access for "reading" or "writing" on the disk is through a magnetic sensing head that can be moved directly to a position over a specified band (See Figure 6). The direct access feature of a disk storage unit is very valuable when fast access is needed to individual records. Although most disk files are organized sequentially to facilitate processing, records can always be accessed directly through a back-and-forth search strategy described earlier.

The processing of a file is often not merely a matter of retrieving or modifying a given record (e.g., RODRIGUEZ' record); it may call for access to several records or even the entire file. Suppose, for example, one wanted to find the average age of all students. In this case it would be necessary to access each record to find the age of each student and calculate the average. Under these circumstances, sequential access of the entire file would be the logical approach and direct non-sequential access would offer no advantage over sequential access.

Suppose, however, one wanted the average age of the students of a specific training program. If a separate sequential file of students

Figure 6

A Magnetic Disk for Data Storage


Band of recorded data
RODRIGUEZ

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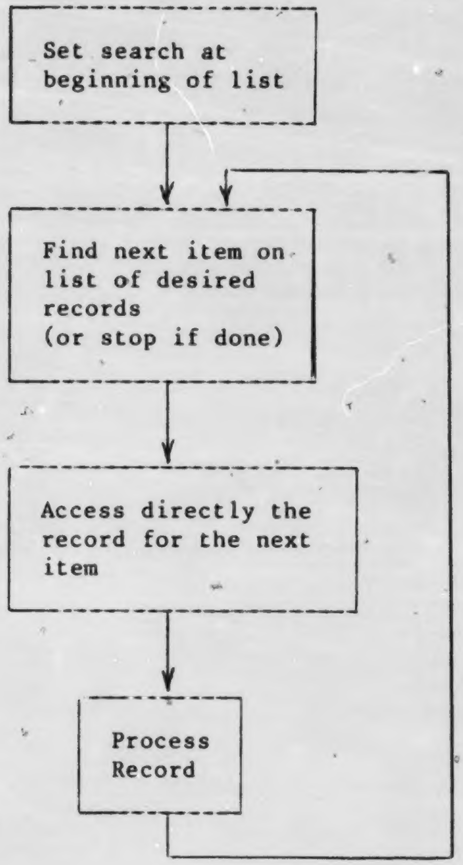
were kept for each program, then this retrieval would be similar to the one asking for the average age of all students, except that only the file of the specified program would be accessed. Such a file organization would facilitate program-related requests for information, but it would hinder requests calling for all of the information about a given student, because such a request would require access to all program files in which a student has been registered. Furthermore, separate program files would result in the duplication of student information in more than one file.

An approach to this program, which is often quite satisfactory, is to maintain a single file that contains all information about students, including the programs with which they are associated. When a retrieval is processed, each student record is accessed to see if it meets the specified conditions (participating in a given course, say). If a record does satisfy the conditions, appropriate information (e.g., the student's age) is retrieved; if the record does not satisfy the conditions, it is ignored and the next record is then read.

If only a small portion of a file needs to be accessed in order to obtain requested information, scanning the entire file sequentially may be time-consuming and inefficient. In such a case, speed and efficiency can sometimes be increased greatly if the storage medium allows direct access. For example, a list of the names of students participating in a given program can be used to directly retrieve from the student file the record of each such student in the program. In this way, the records of all other students need not be accessed. The flow diagram (Figure 7) shows the search process:

Figure 7


Set search at beginning of list
Find next item on list of desired records (or stop if done)
Access directly the record for the next item
Process Record

Selective Search Using a list of Desired Records

A list of items having a given characteristic (e.g., students who participated in a given program) constitutes an index through which records can be retrieved directly. The concept of using an index to associate related records can be extended to multiple characteristics for each record in the file. Suppose, for example, it were desirable to identify each student with the following characteristics:

(1) Training program(s) in which he or she participated

(2) Year attended

(3) Geographical location of the student

(4) Skill(s) acquired

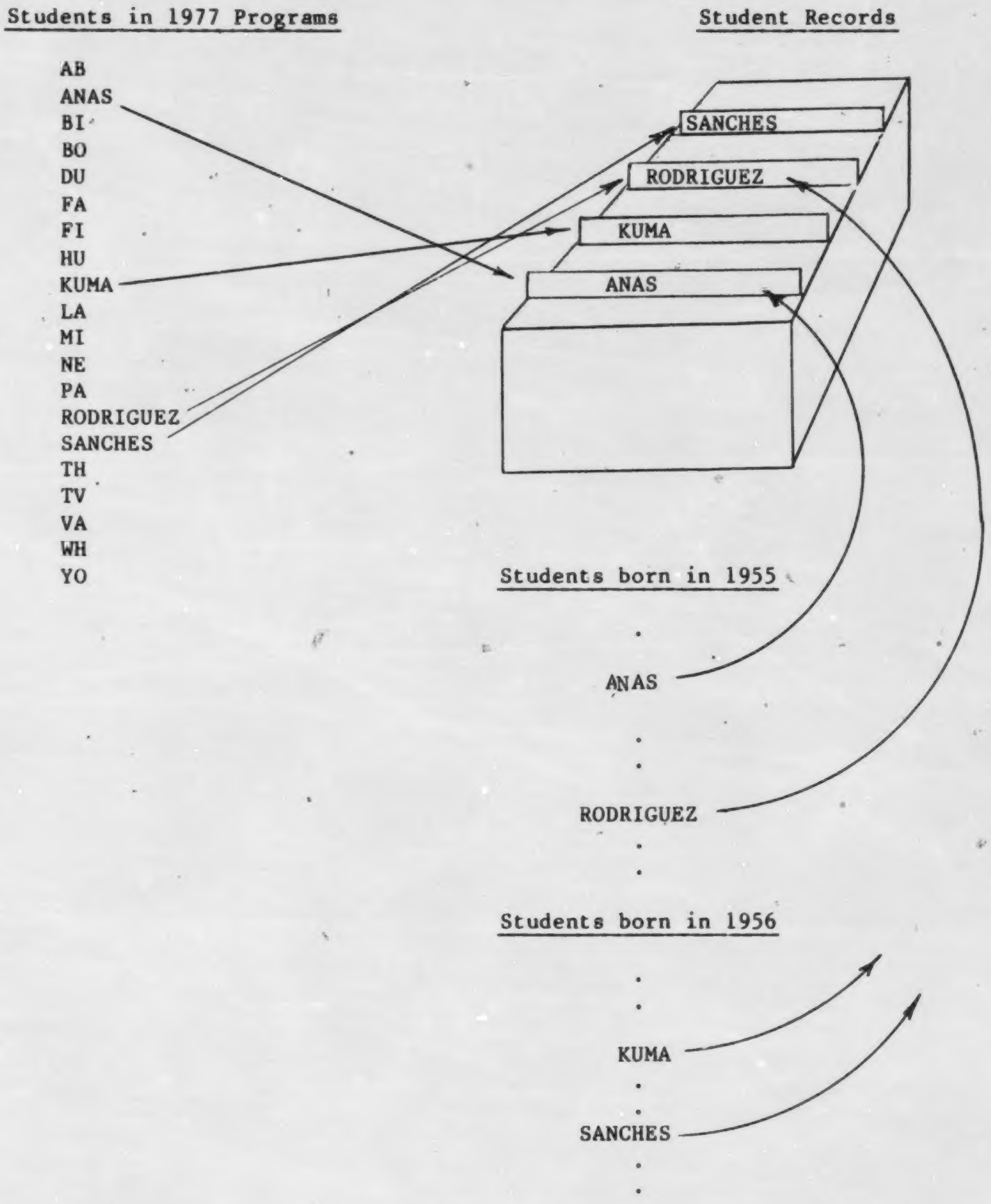
(5) Year of birth

A separate index could be maintained for each characteristic, such as all students who participated in a program in 1978. Each index entry would give the name of a student (or perhaps a unique identification number) having the desired characteristic, which could then be used to retrieve directly the record of the student (See Figure 8)

If more than one selection criterion were specified -- (e.g., all students who participated in a program in 1978 and who also were born in the year 1955 or 1956), the indices of the specified characteristics could be used to identify each record meeting all specified conditions. In this way it is possible to confine the retrieval of records to the ones actually having the desired characteristics.

It is obviously somewhat cumbersome to prepare and maintain a separate index for each possible characteristic that might be specified in a retrieval request. For this reason, the effort is justified for characteristics that are likely to be used relatively frequently. If

Figure 8


Students in 1977 Programs
AB
ANAS
BI
BO
DU
FA
FI
HU
KUMA
LA
MI
NE
PA
RODRIGUEZ
SANCHES
TH
TV
VA
WH
YO
Student Records
SANCHES
RODRIGUEZ
KUMA
ANAS
Students born in 1955
ANAS
RODRIGUEZ
Students born in 1956
KUMA
SANCHES

Students in 1977 programs and born in 1955 or 1956

ANAS
KUMA
RODRIGUEZ
SANCHES

information is desired about a characteristic not included in an index (e.g., the sex of a student), it is necessary to retrieve each record to resolve whether it meets the selection criterion. If an inquiry involves some characteristics that are indexed and others that are not, the search for the unindexed criteria can be confined to records that otherwise meet the indexed criteria. For example, a request for a list of male students who participated in programs in 1978 could be processed by retrieving the record of each student in a 1978 program, and then selecting only the male students from the retrieved records (which assumes, of course, that each student record contains a data element on the sex of the student).

The use of indices can be useful in a manual system, but such a system becomes increasingly difficult to manage as the number of records and indices grows. Relatively simple requests -- involving, say, only a couple of selection criteria and straightforward extraction from retrieved records -- can be handled adequately through a well designed manual system. If, however, several criteria are specified and the processing involves more complex arithmetic operations (e.g., calculating sums of values taken from many different records), a manual system becomes cumbersome, time consuming, and error prone.

Information processing technology has advanced to the point that relatively inexpensive systems (often costing less than $10,000) are available that have sufficient capacity to handle databases consisting of several thousands of records. (Of course, more expensive systems are also available to deal with large systems having millions of records, but they can get very expensive.) Although the cost of implementing and maintaining the system can be considerably more expensive than the original cost of the equipment, the total cost is still often modest enough to justify the investment. Obviously, the decision to develop a computer-based system depends on such factors as the number of records to be stored, the number and complexity of requests for information, and the value of the information to be obtained. If, however, a sufficient need exists for information about educational and training programs, it is certainly technically feasible to develop a computer-based system that can provide such information. The next section (E-3) discusses these issues in somewhat more detail.

SECTION E3

THE USE OF COMPUTER-BASED INFORMATION SYSTEMS

A. WHY USE A COMPUTER?

Computers are becoming very widely used throughtout the world, in government agencies, private firms, and universities. The cost of performing a given calculation such as a statistical analysis, has been coming down by at least 20% per year over the past three decades. The compounded effect over this time period has been a thousand-fold reduction in cost. (Total costs for computing have actually grown substantially during this period, due to the fact that the amount of computing has grown at a very much greater rate.)

Despite their fantastic power, the use of computers is not easy. In too many cases, computers have been used inefficiently and for purposes of relatively low value. A badly designed system can be extremely expensive and frustrating. It is, therefore, important to analyze carefully an organization's need for information in order to determine if a computer can provide a cost-effective solution. Often it is better to use a simple manual system to provide the desired information, or to get by without the information because its value would not justify the cost and effort to collect, store, retrieve, and process the information.

Despite these cautions, however, there are certainly situations in which a computer-based system offers the best means of providing desired information. The primary justifications for use of a computer are as follows:

1. Volume of data.

As the volume of an organization's database grows, it becomes increasingly difficult to stay with a manual system. A database of over a few million characters of information, for example, becomes a reasonable candidate for placement on a computer.

2. Fast response time required.

In some circumstances the primary advantage of a computer is the speed with which it can provide information. This is an obvious requirement, for example, in an airline reservation system, in which a customer must be given a quick answer to a request for a reservation on a given flight. Even in cases that do not call for an immediate response, such as a request by a government official for a status report on NFE programs, the computer may be able to provide the information in a matter of hours rather than the days or weeks that a manual system might take.

3. Complexity of information processing.

The amount of computing depends not only on the volume of data, but also on the complexity of the logic used in processing information. A simple retrieval request requires relatively little processing, and can often be handled adequately with a manual system. If, however, a combination of complex search criteria are used in retrieving information from the database, manual methods become very cumbersome. Statistical analyses may require a great deal of computing, and soon become unmanageable without some form of computer (possibly only an inexpensive hand-held or desk-top calculator).

4. Flexibility required.

If information requirements are difficult or impossible to predict in advance, a manual system may not provide the needed flexibility. Each new request for information could require developing new procedures and training the staff to execute the procedures. A well-designed computer system can provide a flexible means for responding to unanticipated requests for information. Each such request is expressed in an easy-to-learn computer language (which may appear much like a natural human language such as English, French, or Spanish). The request is then processed by the computer and the information is retrieved as specified. Unfortunately many computer-based systems have been designed in a way that does not permit such flexibility, but it is becoming increasingly possible to provide this capability at a reasonable cost and effort.

5. Cost savings.

In certain circumstances, it may be possible to reduce labor costs by use of the computer -- for example, in situations dealing with large volumes of data and relatively complex processing. In most cases, however, an organization ends up increasing its data processing costs as it moves from a manual to a computer-based system. In some cases the added costs may be due to inefficient design or the selection of inappropriate activities to be put on the computer; more often, though, the added cost is due primarily to a greatly expanded range of information that the computer system provides (not always with a careful analysis to justify the added cost).

B. COMPUTER OPTIONS

A very wide variety of computing equipment is now available to meet different needs for information processing. Among the options available are the following:

1. Hand-held or desk-top calculators

Electronic calculators range in price from only a few U. S. dollars to several hundred dollars. The machines that cost the least perform only simple arithmetic operations (i.e., addition, subtraction, multiplication, and division.) More powerful devices capable of performing such standard operations as trigonometric, financial, or statistical calculations range in price from $20 to about $100. At the high end of the range, "programmable" calculators are available that permit the user to program tailor-made repetitive calculations. Although these calculators can perform quite complex operations, they are severely limited in the amount of data they can process. Most of them require that all input data be manually entered from a keyboard each time they are processed, an impractical limitation for all but the smallest databases.

2. Small business computers

Computer systems are now becoming available at a cost low enough to make them practical for even relatively small organizations. Ranging in price from about $5,000 to $30,000, they provide sufficient computing power for handling complex data processing functions and a relatively high volume of transactions. A typical system for a small

Hand-held Calculator

Desk-top Calculator

Small Business Computer

organization might have a single terminal device (e.g., TV-like display screen combined with a data entry keyboard), a central processor capable of performing over 100,000 calculations per second, a printer, and a disk storage device that holds a million or more (up to perhaps several tens of millions) characters of information.

3. Minicomputers

Powerful "minicomputers" are available, and may cost from $30,000 up to $200,000 or more. Compared to the less expensive small business computers, they offer faster computation speeds, more file storage capacity (up to several hundred million characters), and a larger number of terminals that can be supported simultaneously (for example, allowing several clerks to enter data at the same time).

4. Larger computers

The power and cost of computers can grow well beyond the range of the typical minicomputer. The largest computers may cost several million dollars. Basically, they are only capable of the same sort of applications as the minicomputers and small business computers; their advantage (and higher cost) comes from their faster speed, larger storage capacities, increased number of terminals, and wider variety of supporting computer programs ("software") available from the computer vendor.

C. COMPUTER HARDWARE AND SOFTWARE

The computer itself constitutes the "hardware" on which the data processing is performed. In addition to the hardware, however, the user also needs appropriate "software" to perform a desired set of processing tasks. Without the software, the hardware is merely a witless set of electronic devices. The software is the collection of "programs" that instruct the computer to automatically perform the precise set of operations needed to accomplish a given task -- such as updating a record in the student file or calculating the average age of students in a given NFE class.

Two types of software are required. "System" software is the general set of programs, typically provided by the computer vendor, that is needed to operate the computer, but which is not specific to a given data processing application. Included in the set of system hardware is the "operating system," which manages the computer itself, allocates computer resources to detailed tasks, and performs common processing tasks (such as searching for a specified record). Other system software includes language translators (which translate programs written by human programmers in "higher-level" languages into the very detailed language for the computer itself) and various "utility" programs such as one used to sort records into alphabetical sequence.

In addition to this general system software, application-specific programs, constituting the "application" software, are also needed. A program for calculating paychecks or keeping student records is an example of an application program. These applications tend to be specific to a given using organization, and so are usually written by programmers to meet the unique needs of that organization. Increasingly, however, application software can be purchased from software firms. An application purchase (e.g., a payroll program) is usually designed in a way that permits the software vendor or the customer's programmers to tailor it to the specific needs of the organizations. The use of such packages is becoming especially common for small business computers.

D. COST OF DATA PROCESSING SYSTEMS

Although computer hardware is the most obvious and concrete part of a data processing system, its cost is becoming a relatively small part of the total. Consider, for example, the case of a small business computer having a useful economic life of six years, before it is replaced by a more modern computer. Over this time span the cost of the system might typically break down as follows:

Component	Cost	Percent of Cost
Hardware	$ 30,000	18
Hardware maintenance	22,000	13
Purchased software	10,000	6
Staff costs	90,000	53
Supplies, space, misc.	18,000	10
	$170,000	100

Thus, the original cost of the hardware should not be the major consideration in deciding whether a computer system should be installed. Operating costs, principally personnel costs, are a much more significant cost component. As technological advances bring the cost of hardware down still more, and inflation increases pay rates, personnel costs will loom even larger.

E. IMPLEMENTATION OF AN INFORMATION SYSTEM

Developing an information system is usually a difficult process that takes considerable time, money, and patience. The ultimate objective of the process is a set of operational application programs that meet the needs of the organization. In grossly simplified and abbreviated terms, the following steps are involved in developing an information system:

1. Determine information requirements

The first step is to determine what information should be produced by the system. In most situations it is not difficult to think of many types of information that could be produced for use by administrators and operating personnel; the difficult part is determing what information should be produced. In principle, the objective of the information system should be to provide information that balances the value of the information against its cost. Although in practice it is difficult to calculate such a balance in monetary terms, an effort at least should be made to make an informed decision. Prospective users should be asked what information would be valuable to them in operating their activity. To the extent possible, users should provide some sort of weighting that gives the relative value of different types of information. A simple three-category weighting is often sufficient -- e.g., each piece of information could be classified into the categories "must have," "should have," or "nice to have."

2. Design the system

Once information requirements have been determined (at least provisionally), the designers then have the task of designing a system that provides the "must have" information and as many of the "should have" and "nice to have" types of information as appear to be economically feasible. In the course of the design certain requirements may be revised in light of the estimated costs of providing the information. The resulting design defines the outputs expected from the system, the input data needed, and such technical matters as the organization of the files. Rough estimates are also made of the computer resources (e.g., processing and storage capacities) required to implement the system.

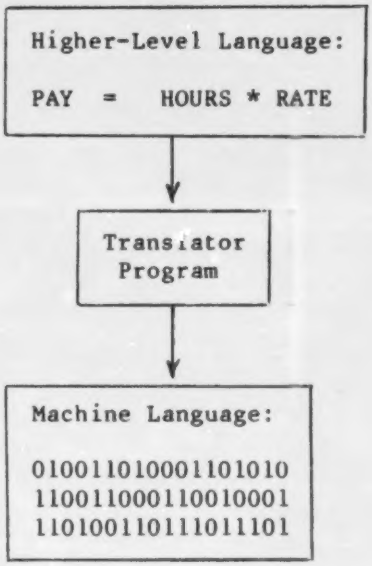
3. Program the system

In order to become operational, the design must be translated into a language suitable for interpretation by the computer. This is done by computer programmers. In most cases they use a "high level" language that is relatively easy for humans to work with while also being capable of being interpreted by the computer. The following statement (in a computer language called Fortran) is an example of such a higher-level language:

PAY = HOURS*RATE (where "*" stands for multiply)

A given program (in this example, one used to calculate employee paychecks) usually consists of hundreds, often thousands or even tens of thousands, of such statements.

Before the program can be executed (e.g., to generate paychecks), it must first be translated into the machine language that it "understands." This is done automatically by the computer, using a translation program. After translation, the program is in a form that can be executed directly by the computer. Thus, in the payroll example, any time paychecks are to be prepared, the machine-language program is entered into the machine (automatically, from machine-readable storage such as magnetic disk).


Higher-Level Language:
PAY = HOURS * RATE
Translator Program
Machine Language:
010011010001101010
110011000110010001
110100110111011101

Translation from Higher-Level Language to Machine Language

Before a program becomes suitable for "production," it must be very carefully tested to eliminate as many errors (or "bugs") as possible. Testing usually takes more time than the original programming, and may even equal the time required for both design and programming. The cost and time required to do careful testing is often seriously underestimated by inexperienced programmers.

4. Maintain the program.

Programs tend to be changed frequently after they are first "completed." Changes may come from new information needs, changes in external requirements (e.g., new legal requirements for regulatory information), or the availability of new hardware or software. It is quite common for the continued cost of software modification to exceed the original development cost of the programs. Because they require such frequent changes, programs should be carefully documented so that a later programmer (including the person who wrote the original program) will be able to understand the logic of the program and thus be able to make the required changes.

F. CONCLUSIONS

Computer systems can be very cost-effective when applied correctly. The cost of computing hardware has come down by a factor of over 1000 during the past three decades, making many applications now economically attractive. Computers are at their best when dealing with large databases (several million characters of information or more), complex calculations (such as statistical analyses), fast response time requirements, and flexible retrieval requirements.

On the other hand, developing a good computer system is not easy. It calls for both technical competence and management wisdom in deciding which functions are to be automated, and those for which a simple manual system is best. Management should not be intimidated from using a computer in situations in which it offers tremendous advantages; neither should management rush into the development of a computer system without being aware of its complexities and pitfalls.

APPENDIX A

SHADOW PRICING

In situations where market prices are not likely to reflect the true cost of resources to society, economists use "shadow prices" in their analyses to correct for such distortions. These shadow prices, which are estimates of the true cost of these resources to society, are necessarily somewhat arbitrary and should be applied with good judgment and caution. Some of the major areas in which shadow prices are used and considerations in their estimation and application are briefly discussed in this Appendix.

1. Taxes and Subsidies

Taxes and subsidies on goods and services are, from the perspective of the entire economy, transfer payments from one group in society to another. From an individual or private viewpoint, taxes are costs which have to be paid and should be included in financial analysis. From the perspective of the entire economy we see that the taxes paid on goods and services purchased by the project are really funds which are transferred to the government which can then spend these monies to benefit society as a whole. Hence, in economic analysis from the national government perspective, taxes may be excluded from a project's costs. Where market prices include tax components, the latter may be subtracted to reflect true economic cost.

In Example A.1 (see end of this appendix), the subtraction of taxes on the land rovers reduces their cost to the project from $45,000 to $36,000 or 25% less. Similarly, in Example A.2, the import duties (if not subtracted) would have raised the cost of equipment to the construction project. This argument applies to all taxes -- income taxes, sales taxes, local taxes, import duties, etc.

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In the same way, subsidies, which act to reduce the prices of certain items are, in effect, a transfer payment to the project (or to its participants) from the rest of society. Hence, from an economic perspective, market prices may be adjusted to remove the effects of the subsidy. Assuming the subsidy reduces prices paid by the project, these prices may be increased by the amount of the subsidy. Thus, in Example A.3, fertilizer which is subsidized by one-third to sell for $18.00 per hundred pounds on the market has a true cost to the economy of $27.00 per hundred pounds.

2. Wage Rates Under Conditions of Insufficient Employment

Previously, we outlined procedures for calculating the unit costs of labor using the wage rates, benefits, and other forms of compensation received by the worker. The resulting unit price for labor is the estimate of prices for financial analysis of private profitability. In addition, where the problem of unemployment is not serious, these costs are also an acceptable approximation of unit cost from a social point of view.

In developing countries with significant unemployment and underemployment, the wages paid by projects to labor, particularly unskilled labor, may overstate the cost to the economy. The labor is not being diverted from equally productive activities since the labor used had previously been unemployed or partially unemployed. Traditionally, examples of this situation (as in Example A.4) are found in crowded countries with a surplus of agricultural workers. Gittinger (1972) indicates that by taking labor away from a farm community where it is producing nothing and putting it to work producing something elsewhere, we do not have to give up any production in order to realize the new product. This being the case, it is often argued that the marginal cost of that labor is close to zero. In less extreme situations alternative employment for project workers may yield a "true" wage, but substantially below those paid by the project. Here too, as indicated in Example A.5, the differences can be significant.

There are no simple and general rules for determining how much lower the shadow "wages" should be. The foregone earnings of the unskilled workers can often be influenced by factors specific to the situation. Careful consideration should be given to the local and regional employment patterns of workers of comparable skills, as well as the employment history and background of the unskilled project staff and participants. There is growing recognition of the fact that a "zero" shadow wage for labor may not be fair. Even though the economy may not have to forego production as a result of a laborer entering the NFE project, there may be a loss from the other work done by this person on the farm and his or her loss of family support. These factors should also be considered.

3. The Cost of Foreign Exchange

The cost of foreign exchange is another source of discrepancy between actual financial and social project costs. Many developing countries have official exchange rates which tend to overvalue their currency relative to other foreign currencies. In these situations, if the project requires imported resources from a foreign country and the foreign exchange is provided at the official exchange rates, the cost of the imported resource will understate the real cost of that resource to the economy. By obtaining foreign exchange at the official rate, which is below the true value of the foreign exchange, the project has received a subsidy from the government. Thus, in Example A.6, when the official exchange rate is 450 rupees to the dollar (and the true market value is 600 rupees to the dollar) the project is subsidized in the purchase of its tractor by 33-1/3%.

As in other adjustments to market prices, it is easier to demonstrate the need for a "shadow" price for foreign exchange than to determine its value. In principle, the correct shadow price would be the exchange rate level that would apply it there were no barriers to trade (i.e., no tariffs or quotas on imports) and if there was no requirement by the central bank to buy or sell foreign currency at the official exchange rate. While it is often difficult to determine what the free market exchange rate would be, a relevant indicator is the ratio of the central bank's foreign exchange reserve holding to the country's annual imports. Thus, if the central bank has a large (and rising) supply of foreign exchange reserves relative to imports (e.g., to cover imports for more than four or five months), it can generally be assumed that the official exchange rate is not exceptionally overvalued. On the other hand, if the central bank has a low or dwindling supply of foreign exchange, this may indicate that the official exchange rate is overvalued. Further signs of currency overvaluation can be determined by looking at the pattern of the country's foreign trade. For example, a large (or growing) trade balance deficit relative to the country's GNP is likely to signal extensive currency overvaluation.

It is generally best to use the "shadow" price for foreign exchange provided by central planners. If such information is not available, project officials may wish to request and use information on the country's relative inflation to calculate a "shadow price" for foreign exchange based on the principles of purchasing power parity.

The principle of purchasing power parity adjusts the official exchange rate by the difference in the country's annual inflation rate less the annual inflation rate of its major trading partner. Hence, if the country's inflation rate each year is 10 percent higher than that of its major trading partner, the price of foreign exchange should be adjusted upwards by 10 percent. The reasoning behind this procedure is that currency depreciation is necessary to offset the cost differences at home and abroad, and, thereby will enable the country to compete in international markets, even though it has a higher inflation rate.

Example A.1

A radio learning project in literary skills purchases three land rovers to transport field supervisors to the various NFE project sites. The rovers cost $12,000 each and are subject to a 25% tax which amounts to $3,000. Thus, the financial costs of the land rovers to the project are $45,000. However, since the tax is paid to the government which can then redistribute the $9,000 to other sectors of the economy, the cost to the economy of purchasing the land rovers is $36,000.

Example A.2

Let us assume that a Ministry of Education has to buy $100,000 worth of imported equipment subject to a duty of 40% and that the Ministry is not exempt from paying the duty. It will, therefore, have to pay the equivalent of $40,000 in duty so that the total cost of the equipment to the Ministry will be $140,000. What is the cost of the equipment to the economy? The $100,000 of foreign exchange that is spent on the equipment is clearly a cost to the economy because this foreign exchange could have been spent on other imported goods. But what about the equivalent of $40,000 that the Ministry has to pay in import duty? Is that a cost to the economy? This depends on whether the $40,000 represents an absorption of resources that would have alternative uses with an economic value of $40,000. But the $40,000 is nothing more than a transfer payment from the Ministry of Education to the Ministry of Finance. Exempting the Ministry of Education from paying the tax or removing the tax would not reduce the cost of the equipment to the economy, and would not release any economic resources for other uses, any more than an increase in import duties or taxes on the equipment would raise its cost to the economy. (Sirken, 1977).

Example A.3

In order to encourage the use of a highly effective nitrogen fertilizer, the government of Ruritania has subsidized its purchase price in the open market with a 33-1/3% subsidy. Thus, 100 pounds of fertilizer whose true cost to the economy is $27.00 sells for $18.00 with the subsidy in effect.

An NFE project teaching new rice growing techniques purchases 400 pounds of fertilizer to use in its demonstration fields. The purchase price of this resource to the project is $72.00. However, the cost to the economy of the fertilizer is $108 -- the purchase price of $72.00 plus the 33-1/3% subsidy of $36.00. Hence, the relevant cost figure for a broad social evaluation of the NFE project in new agricultural techniques is $108.

Example A.4

The trainees in a rural NFE program teaching basic carpentry skills are drawn from nearby family farms. These young men are members of large families farming small plots of land so that family labor cannot be adequately utilized. In such situations, even if several of the children in the family find productive employment elsewhere or enroll in the NFE program, the total production on the family farm would not be reduced. Hence, the marginal value of the agricultural labor alternative of the trainees would be close to zero.

Example A.5

In this case, the NFE trainees in the carpentry program are migrant farm laborers who are employed full-time four months during each year and earn $100 per month (or $400 total) over this period. In addition, these men average about $30 per month ($240 total) over the remaining eight months doing odd jobs. During the year that the men are enrolled full-time in the NFE project, the economy is deprived of $640 worth of their production and this figure represents the cost to the economy of the time they spent in the project.

Example A.6

A tractor produced in the United States is purchased by an NFE project teaching the operation and maintenance of farm machinery. The tractor costs $18,000 which, using the official exchange rate of 450 rupees to the dollar, is equivalent to a purchase price of 83,250 rupees.

However, the official exchange rate has not been adjusted to reflect the actual scarcity of foreign exchange in the country. Indeed, the true value of foreign exchange, if there were no trade barriers or central bank intervention, would be 600 rupees to the dollar. Hence, the true cost of the tractor to the economy is 111,000 rupees or 33-1/3% more.

APPENDIX B

THE NICARAGUAN RADIO MATHEMATICS PROJECT

Pages 341-51 were removed prior to submission to the ERIC Document Reproduction Service.

See Jamison, Dan T. The Costs of Educational Media Guidelines for Planning and Evaluation. Beverly Hills/London: Sage Publications, Inc. 1978.

APPENDIX C

SOME STATISTICAL CONCEPTS

Universe

The total of what shows or could show the phenomena considered is called the universe. For malaria, this is probably all the population of a region or a country; for a unique professional school, this may be a very limited number of trainees and ex-trainees only.

Small universes should -- for reasons stated below -- most often be studied and analyzed in their entirety; large ones can be represented by samples. But the question of what constitutes a universe has its pitfalls. Suppose one is studying specific attitudes toward innovations in cattle-holding and breeding. A sample of thirty from a village may seem very acceptable. But if it can be expected that these attitudes are affected by owning or not owning cattle, and if it's important to find out, this sample can easily turn out to be inadequate. It is unlikely that two sub-samples within a total sample of thirty will show differences which can be considered reliable. Each sub-sample must be looked upon as a sample of its own universe, and should be large enough to represent that universe.

Subdivisions in small universes are often too small in any case. Suppose the above unique professional school has finished its first course; twenty-five have taken the diplomas and five have dropped out during the course. Those five do not lend themselves to statistical analyses. But it may be very worthwhile to include them in the final interview concerning the course, because they -- magnified as it were -- are likely to give valuable clues for the interpretation of what is found out in the interviews with the twenty-five who finished the course.

Sampling

Many development projects are intended to reach considerable numbers of people. Obtaining information on project results by observing or questioning the entire group of people potentially affected would be wasteful. By observing or questioning only a fraction ('sample') of the group, the desired information can be obtained more economically, more quickly, and very often more accurately than by including the entire group.

It is essential, however, that the sample be selected properly, that is, by relying on the laws of chance in the selection process. Otherwise, biased or erroneous conclusions may be drawn.

The two major characteristics of a sample are:

1. Its size -- Large samples (over one hundred) are needed relatively infrequently in studying development projects. Many useful kinds of data can be obtained from samples of ten (persons known to be well-informed) or twenty (cross-section of a whole community or region).

Adapted from Hayes (1966)

2. Its representativeness -- A sample cannot fairly represent the whole if the persons in the sample differ substantially from those not in the sample, and if these differences are related to the kinds of data being collected.

Size of Sample

Samples must of course be large enough. The fallacies that can emerge from anecdotes of a single instance or from study of a very small group are well known. It is very difficult to avoid bias of some sort in any very small sample. On the other hand, because a development project usually affects a limited area or a limited class of people (for example, teachers in technical schools), and because the persons affected are thus a good deal more homogeneous than when a national survey is undertaken, a sample of twenty individuals (if effort is made to avoid bias in the sample) will provide a good deal of useful information, particularly if one is interested only in fairly marked changes. A hundred individuals, if efforts to avoid bias in selecting them are made, will usually be enough to indicate fairly precisely the direct effects of a development project. Great precision in the measurement of such effects is unnecessary, because changes to be socially significant must be sufficiently marked to show up under even quite crude measurement.

The size of sample needed is obviously related to the variability of data obtained. If, in interviewing a representative sample of families, the first twenty all said that they spent between 10 per cent and 30 per cent of their income for rent (see Table 1), one could accept this as indicating the range of rent/income ratios for the whole community.

Similarly, if all, or all but one, members of a representative sample of twenty said that they were in favor of building a school, it would hardly be necessary to inquire further. Where substantially identical or unanimous results are obtained from representative samples, therefore, the samples used can be quite small.

On the other hand, if there is great variation in replies, or if a large measure of disagreement exists, then substantially large samples are required. Even here, however, the samples need not be very large unless it is important (which is rarely the case in studying development projects) to get precise measurements or to identify or measure small differences between one group and another. Usually, findings that might be utilized in planning projects, and the project results themselves, are either large enough to show up in small samples, or are not important enough to justify the time and expense of using large samples.

For example, consider the results of a survey of working-class households in York, United Kingdom. The income of each family was determined, and then the rent each family paid was expressed as a percentage of income. Dividing the whole group into five income classes, the following table shows the percentage of income spent for rent by all households in each class. It also shows the percentage obtained from a sample comprising only one out of fifty households in each income class.

Table 1. Percentage of Income Spent for Rent

Income class	Complete survey		Sample 1 in 50	
	Total number of households	Percentage	Number in sample	Percentage
A (highest) . .	1748	26.5	34	27.1
B	2477	22.7	67	22.6
C	2514	19.8	46	18.0
D	1676	15.8	35	16.9
E (lowest) . .	3740	11.3	77	11.5

While the results from the sample differ in each income class by up to 2 per cent from the results of the complete survey, the same factual conclusions can be derived from the sample as from the whole. It is seen that in this community, the percentage of income spent on rent has a consistent and important relationship to income level, being more than twice as large in the highest income group as in the lowest. This finding was obtained by using a sample of from thirty-four to seventy-seven households in each income class.

Another important point is illustrated in this table. If the whole sample (in this case 259) is broken down into sub-samples, it is the size of each sub-sample which is at issue. Many survey samples in the United States and Europe are quite large (2,000 to 3,000), partly so that numerous sub-groups can be studied separately, and partly to permit identification of relatively minor differences among sub-groups, or between these sub-groups and similar sub-groups studied in other surveys.

The size required for samples under certain conditions is indicated in Table 2. To use this table, one may first estimate or guess at the percentage to be used in entering the first column, or one may actually obtain responses from a first sample of twenty-five or so. If this sample is representative, their responses will often provide enough indication of homogeneity to permit planning the size of the final sample. These plans, however, may have to be altered later if it is found that the first sample was not representative.

Table 2. Sample size required when 'margin of error' of specified size is tolerable (calculated for questions requiring only 'Yes' - 'No' or 'Favor' - 'Oppose' reply).

If approximately the following percentage say 'Yes':	And if it is satisfactory to have a 19-out-of-20 assurance that the 'margin of error' percentage is not larger than:	An adequate sample is:
50	20	25
	10	100
	5	400[a]
	2	2400[a]
70 or more, or 30 or less	20	20
	10	80
	5	300[a]
	2	2000[a]
90 or more, or 10 or less	10	35
	5	140[a]
	2	900[a]

[a] This precision and therefore this sample size is ordinarily not needed in guiding the administration of development projects.

There are no rules for entering the second column. This is simply a decision one must make, in the light of the importance attached to accuracy of results and the cost of getting enough interviews to reduce the margin of error.

Table 2 can then be used as follows. Assume that 70 per cent of a representative first sample drawn from a village of several thousand can, when asked, give the name of the local village extension worker. Even if the sample contains only twenty persons, one can be 'reasonably sure' (nineteen chances in twenty) that at least 50 per cent of the total population (which may be several thousand) know his name, and perhaps 90 per cent know it. (50 per cent is 70 per cent minus 20 per cent; 90 per cent is 70 per cent plus 20 per cent; the 'true' answer for the whole village is indicated to lie within 20 per cent above or 20 per cent below the 70 per cent figure obtained.)

Conversely, if it is desirable to establish the fact that at least 60 per cent of the whole village know the village worker's name, the sample size should be increased to eighty. If 70 per cent of this sample of eighty knows the village worker's name, one can be 'reasonably sure' that this is not in error by more than 10 per cent.

If, in the process of getting these additional responses, the proportion of the sample knowing the name climbs from 70 per cent to 90 per cent, one can stop with a sample of thirty-five or less. With a sample of thirty-five and a response of 90 per cent knowing the name, one can be 'reasonably sure' that at least 80 per cent of the whole village knows the worker's name (90 per cent with 'margin of error' of 10 per cent).

As indicated in the example above, the required sample can be small when the results obtained do not differ greatly from person to person. The data on percentage of income spent for rent showed relatively little variation. Answers to a 'Yes' - 'No' question vary much more widely, as an individual can really only answer 100 per cent 'Yes' or 0 per cent 'Yes,' with no gradations between. Samples used for such questions generally need to be larger than where intermediate gradations of response are possible, although groups giving very high (90 per cent or more) responses in one category can be represented adequately by quite small samples. As indicated earlier, the general principle is that the more homogeneous the population the smaller the sample needed.

One way of reducing the size of the sample needed is to stratify the sample. This means breaking it up into groups, each of which is internally more homogeneous than is the group as a whole (this was done in the study reported in Table 1). A relatively small sample can then be taken from each sub-group and the results are then weighted by the reciprocal of the fraction comprising the subsample before being added together. This method avoids unnecessarily large representation of particularly numerous sub-groups in the total sample.

Sample size does not have to be finally determined before undertaking a survey. A series of small samples (if each is representative) can be studied, and the results examined. If great homogeneity is present, or if successive samples give similar results, then the search for an adequate sampling frame can be terminated at an early stage. Even if not terminated, the study of early small samples to provide a basis for the designing of subsequent samples will result in saving the total time and money necessary to obtain results of a prescribed precision.

Representativeness

How to avoid bias? The mistake to avoid is allowing a selection method to be used that depends on factors that are related to the operations being performed or to the effects desired. If, for example, one is measuring the impact of a fertilizer demonstration program, one should not limit the sample to the farmers who were already buying fertilizer from a dealer at the beginning of the program. A later survey of the same farmers would miss all the newly converted fertilizer buyers. Similarly, one would not limit the sample of malarial patients to those who came to the clinic for treatment, ignoring those who were too ill, or not ill enough, or too poor, or too afraid, to come to the clinic. In both examples, "self-selection" would be an important bias factor.

Representativeness, or freedom from bias, in a sample depends mainly on proper procedure in the drawing and collecting of the sample. The objective here is to give every person in the whole group, or in each sub-group if the sample is stratified, a known chance of selection. This usually means an equal chance of selection, at least within each sub-sample.

This objective is most important if precise results are sought from a sample of a large and heterogeneous population. When one is seeking only rather obvious results, in limited and fairly homogeneous groups, not as much attention needs to be given to refined methods of getting a representative sample; but, of course, any action that is feasible to take to improve representativeness will add conviction to the conclusions reached.

The following are the chief methods by which an equal chance of selection can be attained.

Simple random sampling. One can write on a separate slip of paper the name and address of every person or family who might be selected, mix all of the slips together, and then draw the requisite number of slips at random. Sometimes the mix is poor, however.

Systematic random sampling. One can file all the slips prepared above or use lists already prepared for other purposes (if believed to be complete lists), and then count the number of names and decide on the size of the sample. If there are 5,000 names and one wishes a sample of 100, one can simply choose every fiftieth name from the file or list.

If there is any reason to suspect that a list has some repetitive pattern, such as one based on multiples of five, one should of course avoid intervals which are related to the pattern. In the example just cited, if one suspected a pattern based on a multiple of five, the whole list might be divided into 10 sections of 500 each, and within the first section one might take every fiftieth name, starting with the first; in the second every fiftieth name, starting with the second, and so on.

Stratified random sampling. As indicated above in discussing the size of the sample, substantial economies can be obtained by dividing the whole group being studied into sub-groups, each of which is internally more homogeneous than the whole. For example, families living in high income areas may be put into one group or stratum, those in middle income areas may be put into another, those in low income areas may be put into another. Different communities located near a development project may constitute separate strata or the persons known to be favorable to an expert may be one stratum, and those critical of him another.

If the different strata differ in their responses to the questions asked, the results from a stratified sample will be more reliable than those from an unstratified sample. Within each stratum, of course, every person must have as much chance of being selected as any other person.

For many studies, particular groups or strata are more important than others. The whole population of a community might well be stratified; and then 100 per cent of the leaders might be interviewed, along with 50 per cent of the storekeepers, 25 per cent of the other urban dwellers, and 10 per cent of the farmers (assuming that the farmers were the most numerous group). The sample of each group to be studied must meet the tests for size indicated above, but it is not necessary for each sample to include the same percentage of its group. Of course, if the results are to be combined to give single percentages or averages applying to the whole community, appropriate weights have to be given to the results from each sample when calculating the combined figures.

Cluster sampling. The foregoing three methods limit the number likely to come from any one family to one or two persons. In studies in which it is desirable to interview the whole family, or the head of the family in every case, use can be made of lists of families (or other natural groupings) and then one or more individuals can be selected from each family. Lists of villages may be similarly used. This method requires expert statistical guidance, and is mentioned here only to indicate its availability and pertinence.

Area sampling. This is another technique that requires expert statistical guidance. If enough is known about the geography of the area primarily affected by the development project, it may be possible to lay out the area in a substantial number of separate sub-areas, preferably of approximately equal population size. If areas are unequal in population size, attempts should be made to estimate the relative population size of each. Within each sub-area, however, some rigid technique must be used so that the sample is not made unrepresentative by containing just those people living on main roads, or just those on the first floor of apartment buildings, etc. Blindly sticking pins at random into an aerial map of a subarea is one technique sometimes used to force representation of less accessible families. Traveling specified distances in specified directions within each sub-area is another.

Judgment sampling. Samples which do not rely on the principles of chance are usually called "judgment samples." The person drawing the sample may consider that official X or community leader Y should certainly be included in the sample. If each selected person is considered to be a separate stratum, of course, and is given his appropriate stratum weight in the final result, this introduces no bias. If, however, such judgments result in certain persons being represented and certain others excluded without appropriate adjustment in the weighting process, the results will not be representative.

Moreover, if judgments are made that, for example, 25 per cent of the sample should be entrepreneurs, and if it is not known and cannot be reasonably estimated what proportion of the whole group are entrepreneurs, then the results for the group as a whole may be biased by a figure which it is not possible to measure.

If, moreover, quotas are thus established and are allowed to relieve interviewers of the necessity of getting representative persons (by some form of random selection) within each quota group, further bias, of unmeasured amount, may result.

On the other hand, such "quota sampling" (really a form of judgment sampling) is usually better than no stratification at all, for it helps to ensure representation of different important groups, and permits separate study to be made of each such group.

Panels versus successive samples. In studying changes over a period of time, one may select successive samples of comparable composition, or in certain circumstances one may re-interview the same sample. In studying consumer behavior, for example, as was done by the Central Bank of Ceylon, it may be desirable to select a sample of households and then interview them several times. In the United States, "consumer panels" of this kind are often used, and are asked to keep diaries of purchases, reading, radio listening, etc., and to take stock or allow an interviewer to take stock) of the kinds and amounts of goods on hand at periodic intervals.

In some areas, the most feasible way of obtaining desired data on income, expenditures, employment, illness, etc., is by periodic re-interviews of the same sample. Some families themselves can and will keep the daily records required. In many situations, however, it is best to employ a local person to make the entries in consultation with the family.

When a panel is used, relatively small changes over time are often statistically significant, whereas changes of the same size might be ascribed to chance variation from one sample to the next when successive but different samples are interviewed. Thus, for trend studies, results based on relatively few interviews repeated several times with a constant panel can be as reliable as results based on interviews with many more people who are contacted only once. Moreover, more information can often be secured by a series of interviews with the same group, because the results of successive interviews can be cumulated, and because panel members become more articulate over time (partly because they get to know the interviewer, and partly because, between interviews, they think about the subjects studied). It may even be possible to get panel members to cooperate in a development project, for example, by keeping literature available in the house or by turning on certain radio programs. The exposed families thus become the most likely ones to show changes.

The major disadvantages of repeat interviews are: (a) the considerable "drop-out" of respondents from one round of interviews to the next (this is called "panel mortality"), resulting from people moving, becoming ill, dying, or becoming uncooperative; (b) panel members may develop a "critical set," and thus cease to be representative of the general public; (c) panel members may try to be consistent in actions or opinions, from one interview to the next, thus submerging the very changes the development project is intended to produce and the study to uncover; (d) village workers may concentrate their efforts on the sample villages or panel families they know are being surveyed, thus making them progressively more unrepresentative of the whole area.

APPENDIX D

COMBINING AND ANALYZING DATA

The collection of data is only one step, though an important one, toward knowledge of project results. The amount of data collected may be enormous and extremely varied. If pointed, action-directed conclusions are to be drawn from them, substantial efforts are required to combine them, analyze their significance, and interpret them in terms germane to the action decisions under consideration.

Editing

When interview schedules or questionnaires are used to collect data, they must usually be edited before the responses obtained can be tabulated. This editing is intended to detect errors and omissions and get them corrected before tabulation is undertaken. The work of editing is to ensure the accuracy and reliability of the data obtained, their consistency internally (with each other) and externally (with data obtained in other ways), the uniformity with which the data were recorded, their completeness, their fitness for tabulation, and their arrangement so as to facilitate coding and tabulation.

In the editing process, it often happens that some of the data sought are missing, or that inconsistencies appear. If data are missing, it is often possible to go back to the source for the needed information, perhaps by a personal interview, a telephone call, a letter, regardless of how the data were originally collected.

It is also often easy to spot where "years" was written though "months" was meant, where one reply is inconsistent with another from the same respondent, where an error has been made in arithmetic, where "jokes" or faked replies occur or where inaccurate information on age, income and occupation is given. Although it is easiest to catch such errors while the interview is going on, they can often be detected afterwards and the necessary changes made.

Classification and coding

Almost all answers to questions must be grouped into categories before they can be combined.

This process of classification may consist simply of listing as "favorable," "neutral" or "unfavorable" all of the comments made about a project, about an expert's work, etc. It may go far beyond this, however. For example, one might wish to classify much more elaborately the reasons given for favoring or opposing the introduction of a new examination system in the civil service.

Adapted from Hayes (1966)

This same reply may, of course, be classified several times, in relation to each classificatory principle considered significant. For example, here are three ways of classifying possible replies to the open question, "What is your opinion about using tests in selecting civil servants?"

Classificatory principles

Attitude toward tests:	Attitude toward civil servants:	Attitude toward interviewer:
Favorable	Favorable	Cooperative
Neutral	Neutral	Neutral
Unfavorable	Unfavorable	Suspicious
	None expressed	Antagonistic
		Other (specify)

Sets of categories like the three just illustrated should meet three criteria: (a) the categories within any one set should be exhaustive of all possible responses to the question, so that all responses can be classified; (b) the categories within any one set should be mutually exclusive, so that a given response cannot usually be classified in more than one category in that set; (c) each set of categories should be based on a single classificatory principle.

Classificatory principles (and the categories based on them) will in large part have been established before collecting the data, in terms of the kinds of effects expected to result from the development project being studied. Defining these categories precisely, however, deciding how to classify borderline replies, and providing for wholly unexpected replies can usually not be done except on the basis of data obtained in pretests, or the first data obtained in the survey. In any case, these processes must be completed before "coding" can be carried out.

In analyzing the data from any considerable number of interviews or questionnaires, it is usually desirable to classify the respondents as well as the responses. On questionnaires, respondents may be asked to classify themselves according to categories (e.g., marital status; years of school completed) and sub-categories (e.g., single, widowed, divorced, married -- one wife, married -- two or more wives). In interviews, the interviewer usually does this, but may ask the respondents to do so.

Coding is the technical procedure by which replies are transformed into numbers or symbols which can be tabulated. For example, one may assign the letter F to all favorable replies, U to unfavorable, and N to neutral. Marking such letters or symbols in colored pencil in the margin of each interview schedule or questionnaire, in a uniform position, greatly simplifies and expedites tabulation.

Coding replies to closed questions is more or less automatic, although judgment is required even there, especially if one of the permissible replies is "Other (specify)." When open questions are used, coding the replies requires great judgment and considerable training. For such questions, clear definitions of categories of replies are absolutely essential before coding takes place. Sometimes, these categories cannot be established until a good many schedules have been examined, so that recording is necessary of all schedules examined before the final decisions are made as to the categories to be used.

Tabulating

Data from any considerable number of observations quickly lose form and meaning unless they are combined into categories (see previous section), counted by category, and arranged in tabular form.

Assuming that tabulation will be done by hand, it may be done in one of two ways. The categories of response to each question may be listed on a page and then the responses may be tallied alongside, using some form of tallying which simplifies counting, such as 𝍸 or better, ⧄. In each case, the finished symbol represents five. The second method of hand tabulation uses small cards, usually 3 x 5 inches in size. One card is made for each interview or questionnaire and the responses are recorded, usually as numbers or symbols, in predetermined positions on each card. Each position is assigned to a single classificatory category (e.g., age; attitude toward taxes), and each number or symbol stands for one category established for that principle. To tabulate the replies to a particular question, attention is directed to the position used for replies to that question, and the cards are simply sorted into piles, each pile containing cards marked with the same number or symbol in the same position. The cards in each pile are then counted. This can be done very quickly, even for quite large numbers.

The central feature of tabulation is the summarizing of results in the form of statistical tables. If the general nature of the desired tables can be pictured before data are collected and processed, time and money will usually be saved. For example, it will then be possible to eliminate questions for which replies cannot be categorized, to avoid recording irrelevant data during the interviews, and to shorten the work of coding and tabulating. Tabulation of pretest data can be very helpful in working out the kinds of tables needed for the final evaluation report.

Tables are of two basic forms. First, tables may present simple counts of the numbers and percentages of respondents falling into each category of a set. Two examples are shown in Tables 1 and 2 following:

Table 1. Nativity of respondents (fictitious data)

Nativity	Number		Percentage	
Native born	170		85	
of native-born parents.		150		75
of foreign-born parents		20		10
Foreign born.	30		15	
Total	200		100	

Table 2. Attitudes toward introduction of mental tests (fictitious data)

Attitude	Number	Percentage
Favor	110	55
Neutral	44	22
Opposed	46	23
Total	200	100

Tables of a second basic form are used to present cross tabulations of data, thus bringing out possible relations among the factors investigated. This is illustrated in Table 3.

In this table, the (fictitious) data indicate a strong positive relationship between the two factors measured. A much higher percentage of the native-born respondents than of the foreign-born respondents were favorable to the use of mental tests.

Tables serve two major purposes, namely: (a) analysis; (b) presentation. Tables to be used in analysis, or work tables, present all the data, in their original categories, and in as great detail as can be conveniently obtained. Original unrounded figures are used, and percentages are calculated to an extra place. Many of these tables may reveal nothing new or significant, and may be reproduced only in an appendix, if at all.

Presentation tables are selected for their significance. In order to point out the significant facts they reveal, the categories used are often combined, figures are rounded, averages computed, and other clarifying processes carried out.

Table 3. Relationship of nativity of respondents to attitudes toward mental tests (fictitious data)

Nativity	Favor test		Neutral		Opposed tests		Total	
	No.	%	No.	%	No.	%	No.	%
Native born								
of native-born parents	100	66[a]	25	17	25	17	150	100
of foreign-born parents	5	25	10	50	5	25	20	100
Foreign born	5	17	9	30	16	53	30	100
Total	110	55	44	22	46	23	200	100

[a] This illustrates the principle of "forcing up or down" percentages so that the total is 100 percent. The number 100 is 66.67 percent of 150 and 25 is 16.67 percent. The forcing in this case is done on the largest figure, where it makes the least relative change. Usually, forcing is done by increasing or decreasing a figure where it does least violence to the impression given by the unforced set of figures.

Summarizing data

Regardless of the kind of data collected and tabulated, it is necessary to express simply and clearly what is contained in the tables. The statistical measures most commonly used for this purpose are described here briefly.

Counts or frequencies. A simple statement of the number of people or responses in a significant category is the simplest kind of measure. This may be the actual number or frequency obtained by counting the data, or it may be the estimated number or frequency.

If, for example, every tenth child in a school with 100 students is asked what game he likes best, and if six children say they like football best, it can reasonably be estimated that sixty children in the school prefer football. Any estimate derived by an expansion of this sort has a "margin of error." The calculation of this margin is explained in standard statistical works.

Percentages. One of the most useful ways of summarizing data and establishing the relative frequency of different kinds of responses is by calculating percentages. If one divides the number in category A of a particular universe by the total number comprising that universe, and if one then multiplies by 100, one will obtain the percentage in category A. For example, if seventy-four persons are asked their attitude toward using mental tests in selecting civil servants, and if sixty-five approve, the percentage approving is stated as 88 percent.

While this calculation produces the figure 87.84 percent, the last two figures are meaningless when the total is only seventy-four, and are usually dropped by rounding to the nearest whole percent. Moreover, since one of the main purposes of converting to percentages is to provide a figure (proportionate to 100) which can be easily grasped, it is simply muddying the waters to report human behavior, which is in any case variable, in tenths of a percent.

Percentages are extensively used in making comparisons between groups, of course, because they provide a common measuring rod for groups of different size.

Averages. If a large percentage of a group acts in a particular way, we may call this act "typical" of the group. Other measures of what is "typical" are the several kinds of averages.

The mean average (or simply the "mean"). This is the most familiar kind of average. It is computed by adding up the scores (or ages, or incomes, etc.) of respondents and dividing by the number of respondents.

The modified mean. Because a few extremely high or extremely low scores may distort the mean average, a small number of the highest and the same number of the lowest scores (up to one-sixth of each) may be excluded from the calculation. This results in a modified mean, which may be quite useful, provided the method of calculation is explicitly reported. For example, in comparing two surveys at different times, the chance inclusion of a millionaire in one survey and none in the other would make it appear, when true means were calculated, that a substantial change in the average income of the group had taken place. Using a modified mean would avoid such an erroneous conclusion.

The median. The extreme case of the modified mean is the median. Here just less than the highest 50 percent and just less than the lowest 50 percent are excluded from the calculations. The median is determined by identifying the middle score (or calculating the average of the two middle scores), and is also used to describe the "typical" score of the group. An extreme case above (or below) the median has no more influence on the median than any other case above (or below) it.

Variability. It is often desirable to describe briefly the variability of responses obtained, as a measure of the homogeneity or heterogeneity of the group studied. This may be done by stating, for example, that 80 percent of the group gave one out of three possible responses to a question (great homogeneity) or that no more than 20 percent gave any one of seven possible responses (great heterogeneity).

Where data are in the form of scores or amounts, we may use the range (from lowest to highest) to describe how different the individuals in the group are with respect to the characteristics so expressed. Here again, however, the occasional occurrence of extremely high scores may make it desirable to exclude extremes. If the highest one-sixth and the lowest one-sixth are excluded, we have a modified range (comparable to the modified mean), which can be described clearly by saying "The middle two-thirds of the responses fell between X and Y." This measure, if divided in half, is quite similar to the more precise measure called the standard deviation (one standard deviation above and one below the mean will in a normal distribution encompass 68 percent of the response).

<u>Distribution over the range</u>. If responses are charted as vertical bars, some distributions of responses look like the following diagram. This is something like a "rectangular" distribution. Neither very many nor very few responses fall at any one point on the horizontal scale.

```
Number of                X    X
responses      X    X    X    X    X
               X    X    X    X    X    X
               X    X    X    X    X    X
              _______________________________

               Different kinds or amounts of responses
```

Other distributions look like this:

```
Number of      X
responses      X
               X
               X    X
               X    X
               X    X    X
               X    X    X    X    X    X    X
              ____________________________________

               Different kinds or amounts of responses
```

This is a "J curve" distribution. Many responses fall at one end, and progressively fewer fall at each point as one moves away from that end.

Other distributions look like this:

```
Number of                                X
responses                           X    X    X
                                    X    X    X    X
                               X    X    X    X    X
                          X    X    X    X    X    X    X
                     X    X    X    X    X    X    X    X    X
               X  X  X    X    X    X    X    X    X    X    X    X    X
              _________________________________________________________

                  Different kinds or amount of responses
```

This approximates a bell-shape curve, or "normal curve."

It is important to know the shape of the distribution of responses, in order to decide what statistical measures to use in summarizing and analyzing the responses. Many statistical short cuts and special measures have been developed for use with "normal curves" and are inapplicable to other types of distribution curves. If, for example, field data are to be analyzed more elaborately at headquarters, it will help greatly to find out the shape of the distribution of responses so that applicable tests of significance or relationship can be employed.

Differences and relationship based on data from samples.

In evaluating projects, the primary purpose of statistical analysis of data indicating project results, is to determine whether or not significant changes take place which can be attributed to the project or to its separate operations. There are two logical ways of doing this: (a) by uncovering significant differences between the project situation before and the same situation after (so long as like differences do not show up in otherwise comparable situations which were not subjected to similar operations); (b) by uncovering significant project operations. The latter method is inferior, as it assumes without having baseline data that the situations compared were not significantly different before the operations began. It is often all that can be undertaken, however, and it is much better than nothing.

Fairly complex statistical procedures are required to uncover significant differences and to calculate their extent and reliability, where the data used have been obtained from samples. Some rough rules of thumb can be suggested, however.

Suppose a campaign to promote the use of commercial fertilizer has been carried on for a year, and that surveys of fertilizer use have been carried out with four samples of farmers, as follows: sample A in area X (where campaign took place), before campaign; sample B in area X (where campaign took place), after campaign; sample C in area Y (where no campaign took place), before campaign; sample D in area Y (where no campaign took place), after campaign.

Suppose the four samples show the following numbers and percentages using commercial fertilizer at the time of the survey:

Table 4. Farmers using commercial fertilizer (fictitious data)

Area	Before campaign			After campaign		
	Sample and size	Number using	Percentage using	Sample and size	Number using	Percentage using
X (had campaign)	A (76)	20	26	B (85)	40	47
Y (no campaign)	C (90)	24	27	D (88)	30	34

It will be noted that the use of commercial fertilizer increased in both areas during the campaign. Perhaps some general factors were operating during this period to increase the use of fertilizer. A glance at Table 5 will quickly indicate, however, that the apparent increase in area Y from 27 percent to 34 percent was of a size which could have occurred as a result of chance variations from one sample to another. For sample D to have been considered significantly different from sample C, the difference (with the sample size around 100 and the percentage obtained around 30) would have had to exceed 9 percent, whereas it was only 7 percent, well within the variation which might have arisen by chance.

In fact, to be considered really significant, the difference in this case should be compared with the chance variability of not one percentage above but of the difference between the two percentages. Where the percentages compared have about the same chance variability (as indicated in the third column of Table 5), the difference between them will have a chance variability about 1.4 times as great. In the above example, then, the difference between sample C and sample D should have been 13 percent or more to be taken as evidence that any change had really occurred in area Y.

In area X, however, the difference between sample A (26 percent) and sample B (47 percent) was 21 percent, a change extremely unlikely to have resulted from chance variations.

By using Table 5 (interpolating where necessary), and multiplying by 1.4 the larger of the chance variabilities of the two percentages compared, one can readily decide whether the apparent "change" could in fact be explained simply as a chance variation that could have resulted from sampling. If the difference is too large to have been likely to arise by chance, it is reasonable to attribute its cause to the development project or to individual operations which are associated with the difference.

There are numerous other statistical methods of determining and measuring the extent of relationship. These are complicated, however, and for most field studies add little to the percentage difference method described earlier.

All relationships indicated must, however, be examined with the greatest care, to determine whether or not an apparent relationship between factors A and B are both related to C, without any relationship actually existing between A and B. "Spurious" relationships of this sort are common. Men living in large houses more frequently own automobiles than men living in small apartments. Does home ownership bring about automobile ownership? Not necessarily; income is highly associated with both, and so is location of dwelling unit. Logically and then statistically untangling real from spurious correlation is of first importance for all studies of project results.

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Table 5. "Chance variation" above and below obtained percentage

Percentage obtained	Size of sample	The 'chance variation' or 'margin of error' in 19 out of 20 similar samples (per cent)
50	20	±22
	50	±14
	100	±10
	200	± 7[a]
	1000	± 3[a]
70 or more or 30 or less	20	±20
	50	±13
	100	± 9
	200	± 6[a]
	1000	± 3[a]
90 or more or 10 or less	20	±14
	50	± 8
	100	± 6
	200	± 4[a]
	1000	± 2[a]

[a] This sample size, and therefore this precision, is not usually feasible or necessary to guide the administration of development projects.

Finally, it is rarely worthwhile to apply elaborate statistical methods to differences or changes which appear to be small. If a project has not had effects which at least appear to have some significance, why spend time analyzing data? On the other hand, differences often appear to be significant when in fact the proper statistical tests cast doubt on their actual significance. The tests suggested above are more likely to demolish claims of project success than to demonstrate success where none was claimed.

APPENDIX E: EVALUATING NONFORMAL EDUCATION: A HYPOTHETICAL CASE STUDY

by Peter R. Moock with Norman Bander*

I. Introduction

The problems of the Republic of Malthusia differ hardly at all from those faced by the majority of less developed countries around the world--(a) rapid population growth; (b) high rates of illiteracy and very low incomes, especially in the rural areas, which account for more than 80 percent of the nation's population; and (c) a growing but still small urban wage sector, able to absorb only a fraction of the countless would-be employees who migrate each year from the rural areas to the towns. Malthusian planners are looking for programs that will increase the productivity of self-employed rural workers and thereby increase rural incomes. Increasing incomes will make migration to the urban areas a less attractive alternative for rural dwellers. For humanitarian reasons, it is considered especially important to eliminate the extremes of poverty that exist side by side with relative affluence in nearly all of the rural areas.

Toward these ends, a wholehearted attempt is being made to increase agricultural output on the nation's small farms. One of the strategies under consideration is a nonformal education (NFE) program in hybrid maize management to be conducted by the Ministry of Agriculture (MOA) on individual farms around the nation. Maize was selected as the focus of this campaign because, as the staple in the nation's diet, it dominates small farm production. In recent years, scientists at Malthusia's Agricultural Research Station have developed new hybrid varieties with

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the potential for much higher yields than were ever before possible. Hybrid seed is available for sale in small stores throughout Malthusia, at an affordable price since the production and distribution of seed are controlled and generously subsidized by the government.

There is considerable evidence, however, that the desired effect of hybrid vigor on maize yields depends very much on the adoption of certain recommended cultivation practices. It is the adoption of these practices by farmers (so as to increase yields) that is the objective of the NFE program under consideration.

The proposed program will consist of intensive one-day courses in hybrid maize management, to be conducted on the recipients' own farms during the period immediately preceding the recommended time for planting. The instructors for the courses will be existing MOA extension agents, this being consistent with a directive from the Minister that the new program be financed out of funds already budgeted (i.e., that it involve no additional expenditures).

In might be possible to implement the program all at once on a national basis. To do so, however, before conducting a careful pilot study would be ill-advised. The government is looking for programs that allocate resources efficiently given its policy goals. There are many programs that might lead to the adoption of improved cultivation practices and higher yields. The MOA could choose, for example, to conduct on-farm courses, to maintain demonstration plots at all schools, churches, and local government headquarters, or to send farmers to rural training centers for longer (and more expensive) courses in hybrid maize management. Before relying very extensively on any one program, the government planners should try to determine the effectiveness of that program relative to the cost of implementing it, and they should expand the program only if this ratio seems high in comparison with the ratios calculated for all alternative programs. Only then can the government planners feel confident that they are choosing the program that maximizes the nation's return on the money and time being spent.

II. The Evaluation Plan

In accordance with this cautious strategy, the planners in the MOA have decided to conduct an experiment in one particular district of Malthusia, thought to be typical of those areas for which the NFE program is intended. The first step in the experiment will be to select farms that are to receive the special NFE courses. The Ministry has decided that this "experimental group" will consist of 75 farms. (The number of farms could have been larger or smaller than this, but it was decided that 75 is a good "compromise" figure. The proposed courses are costly in terms of MOA staff time, and running many more than 75 would be tantamount to putting the program into effect instead of merely testing it. With many fewer than 75, on the other hand, the results of the experiment would tend to be inconclusive.)

Before selecting farms, it is of course necessary to decide first what is a "farm" and what is not. The designers of the NFE program have decided to define as a "farm" any piece of land on which crops are grown and over which there is a single person (the "farm head") in charge of important farming decisions. Fortunately, there is a word in the Malthusian language that corresponds almost exactly to this concept, so the MOA officials anticipate little or no confusion on the part of the MOA field staff.

Next, it is necessary to decide how farms will be selected. With some 50,000 farms in the district, on what basis is the Ministry to single out just 75 farms for special treatment? Because the early successes (and failures) of the NFE program must necessarily fall on a small number of farm families, it is considered desirable that the selection procedure be as fair as possible. For this reason in part, the planners have decided that the selection of 75 farms will be done on a random basis.

A "random selection" of farms is a group whose make-up has been determined strictly on the basis of chance. (Lotteries operate on this principle. In Malthusia's National Charity Sweepstakes, the stubs of all tickets purchased are placed in a large barrel. On the final day of the Sweepstakes, the barrel is well shaken, and then the President of the Republic, blindfolded, draws one stub from the barrel. The holder of the ticket matching this stub becomes the grand prize winner. The President continues to draw stubs until ten prize winners in all have been announced.)

Random selection permits no human bias to influence who is selected and who is not. Under a random selection, every farm in the district will have an equal chance of being selected for the NFE course (just as every person who holds a ticket in the Charity Sweepstakes has an equal chance of becoming a winner). A half-hectare farm in the farthest corner of the district will have the same chance of being selected as a ten-hectare farm located right next to the district headquarters.

A second reason for selecting farms on a random basis is a practical one. The experiment is intended to determine how effective the NFE program would be on average if it were implemented on a large scale. If the observed effect on just 75 farms of the one-day courses are to tell us anything about the probable effect of the courses on the rest of the farms in the district, it is essential that the composition of farms in the small group resemble very closely the composition of farms in the population.

If it were found in the Malthusian experiment that one-third of the 75 randomly selected farms consisted of less than two hectares of land, then we could say that there is a "very good chance" that one-third of all farms in the district consist of less than two hectares of land. The Malthusian planners hope that the NFE experiment will be successful in increasing the average yield on the 75 farms. More importantly, however, they want to know that whatever success is observed will be replicable. By experimenting with a random sample of farms, they can feel reasonably certain that the observed effect of the program in the initial stage will continue if and when the program is expanded.

A good way to begin selecting 75 farms at random would be to acquire a list of all farms in the district. Since no such list is available, however, and since to compile a list of all farms would take many long months, the MOA officials have decided on a short-cut method of selection that adheres, nevertheless, to the principle of randomness. The selection procedure will consist of two stages, first the selection of a number of small areas within the district and then the selection of 75 farms within these areas.

To describe in detail the procedure to be used in Malthusia, the planners will begin with a map of the district in the 1:50,000 series (in which a distance of one kilometer on the ground is represented by two centimeters on the map). This map, published by the Survey of Malthusia, shows (a) administrative boundaries; (b) man-made features, such as roads, tracks, markets, and schools; and (c) topographical features, such as streams, valleys, forests, and swamps. Using such features on the map, the planners will divide the entire district into small areas of roughly equal size, averaging about two square kilometers. When the areas have been specified, they will be numbered (or otherwise labeled). From this list, 10 areas will be selected at random. (Like the decision to select 75 farms, the decision to select 10 areas represents a compromise. Any larger number of areas would be preferable, but it has been decided that 10 areas will be "sufficient.")

The random selection of 10 areas will proceed as follows. Suppose that 710 areas have been identified, and the areas listed in some order. The planners will then divide the list of areas into 10 "short lists," of 71 areas each. Next they will place 71 pieces of paper labeled "1," "2," "3," etc., to "71,"in a box, shake the box, and select one number blindly from the box. Suppose that the number "15" is selected. Using this number, the planners will designate the fifteenth area in each short list as one of the 10 sampled areas.

The next step will be to compile a list of all farms in the 10 randomly selected areas, a far easier task than listing all farms in the entire district. The enumeration of farms will be carried out by the MOA field staff, who will work closely with the village leaders living in the 10 areas. From the complete list of farms in the 10 areas, 75 farms will be selected at random, using a similar procedure to the one described above for the selection of areas.

The experimental group will now have been identified. According to the plan, each of the 75 farms will be given additional MOA assistance in the form of a one-day course in the principles and practices of hybrid maize management. The information covered in the one-day course will include recommendations on soil preparation, on the time of planting, on the spacing of plants, on the interplanting of legumes, on the use of insecticides and chemical fertilizers, and on weeding and harvesting techniques. At harvest time, the MOA field staff will return to each of the experimental farms to measure the maize yield (output per hectare).

Of course, the yield information acquired will be meaningless without some standard with which to compare it. To determine the effect of the NFE program on maize yields, it is necessary to know what the yields on the 75 farms would have been without the NFE program. The effect of any program may be defined as the difference between what happens with the program in operation and what would have happened had the program not been in operation. How will the MOA determine what yields would have been obtained on the 75 farm in the absence of the NFE program?

One way to approach this problem would be to find out what yields were obtained last year (before the NFE courses) on the 75 farms and to assume that this year's yields would have been much the same. Unfortunately, farmers in the district do not keep very accurate records of yields and, even if they did, might be reluctant to report these records to nonfamily members. Alternatively, the MOA could decide to delay the experimental program one year and itself measure yields on the 75 farms in two successive years, first before and then after the NFE courses. Although methodologically sound, this plan would require an additional year in reaching a decision regarding the effectiveness of the program and, therefore, has been rejected by the MOA planners.

The Malthusians will avoid the disadvantages involved in collecting information on yields over time by using a different method. This method will involve the selection of a second set of 75 farms. The farms in this group, called the "control group," will be similar to those in the experimental group except that they will not receive the NFE courses. If the farms in the two groups are similar enough, then the difference in the amount of maize produced by the two groups can be attributed to the NFE courses received by the experimental group.

In order for this procedure to be effective, however, the Malthusians must be careful to ensure that any new knowledge on maize management given to farmers on the experimental farms does not "leak" and affect practices on farms in the control group. If this were apt to happen, then the Malthusians could not be certain that the average difference in maize production between the two groups revealed the full effect of an NFE course on a farm's production; the spillover of knowledge would have "contaminated" the control group and made the experiment invalid. For this reason, the Malthusians want to be sure that any farm in the experimental group is far enough away from all farms in the control group that there is little chance of information being communicated from the first group to the second.

As with the selection of farms for the experimental group, the selection of farms for the control group will be done in two stages. Again, ten areas will be selected at random from the areas designated within the district and then 75 farms selected at random from the population of farms within these ten areas. Except for one difference, the selection procedure for the control group will be identical to that used for the experimental group.

To minimize the likelihood of control group contamination, it has been decided that the ten new areas selected must not border any of the first ten areas selected. If an area is selected that borders one or more of the first ten areas (or if it is one of the first ten areas), this selection will be rejected and another made in its place. This procedure will be continued until ten new areas sharing no borders with any of the experimental areas are selected.

It has been suggested in the discussion above that the full effect of the NFE program on agricultural production in the district might exceed the effect observed on those farms actually receiving the NFE courses. Some farmers who do not receive courses on their own farms may benefit by observing or speaking with farmers who do. This additional effect may be labeled the "demonstration effect" or, alternatively, the "spillover effect."

To identify and measure this effect, the planners will include a third group of farms in the experiment. Unlike the control group, this group should consist of farms that are close to farms in the experimental group. To select this group, to be called the "spillover group," the Malthusians will begin with the same ten areas from which the experimental farms have been selected. Having already prepared a list of all the farms in these ten areas and having selected 75 at random to receive the NFE courses, they will now select an additional 75 at random from the same list. This procedure will ensure that no farm in the spillover group is more than 1.5 kilometers from the nearest farm in the experimental group, and many will be much closer than this.

III. Measuring Maize Yields

At harvest time, some nine months after the NFE courses are offered on the 75 experimental farms, the MOA field staff will visit all 225 farms (experimental, control and spillover) to measure maize yields (output per hectare). An accurate estimate of each farmer's maize yield will be obtained by means of a sampling procedure. This is much more practical than attempting to measure accurately both the total output and the exact size of each of the 225 maize plots.

After scanning a maize plot and choosing four areas that appear representative of it, the MOA extension agent will mark out a five meter by five meter square in each of the four areas. To assist him in doing this, he will use a 20 meter rope that is divided into four equal parts by pegs that can be secured in the soil. If the farm has row planted the maize as most farms in this part of Malthusia do, the extension agent will lay the first edge of the square equidistant between two adjacent rows in order to get a representative number of maize plants in the square.

All the maize within the four squares will be harvested and the ears set aside to dry for a minimum of two weeks. After drying, the maize will be shelled, and the shelled maize weighed.

Based on this sample of the farm's harvest, an estimate of the farm's output per hectare is easily arrived at. Since the four sample areas sum to 100 square meters and there are 10,000 square meters in a hectare, the estimated output per hectare equals 100 times the measured output taken from the sample areas.

IV. Results of the Experiment

The MOA evaluation plan calls for the comparison of similar farms across experimental, spillover, and control groups to see if there are differences on the average in output per hectare. The random selection of farms to be in each of the three groups will ensure (or make it highly probable) that the three groups were essentially similar to one another prior to the NFE courses. If, after the NFE courses, the farms in the experimental (and spillover) group(s) obtain significantly higher yields than those in the control group, then the planners will be correct in concluding that the NFE courses have had an effect.

The effect of the NFE courses on yields consists conceptually of two components. First, farmers in the experimental group (and, if they follow this group's example, farmers in the spillover group as well) may be expected to adopt some or all of the recommended maize management techniques covered in the NFE courses, and this improved husbandry should result in larger yields. In addition, farmers in the experimental (and spillover) group(s) may be induced to use larger quantities of chemical fertilizer per hectare, and this response to the NFE courses should also increase yields. (The experimental and spillover farmers may end up using more labor, more seed, and more of other inputs as well, but the MOA anticipates that, in terms of a farm's money outlay, the most important change will be in the use of fertilizer.)

Now let us suppose that the MOA plan is complete and a year has passed. The NFE experiment has been conducted. Courses were given on 75 "experimental farms," and yields sampled on these and 150 other farms in two groups, one group "far from" and the other "near" the farms in the experimental group.

Tables 1-3 tabulate some hypothetical results of the experiment. Table 1 indicates that farms in the experimental and spillover groups did use somewhat more chemical fertilizer than farms in the control group. The average quantity of fertilizer used was 128.5, 110.9, and 104.0 kilograms per hectare by farms in the three groups respectively. The remainder of the table indicates the number of farms in each group that applied no fertilizer, and the numbers that applied 1-80, 81-160, and 161-240 kilograms per hectare.

Table 1

Fertilizer Use by Farm Group

		Number of Farms				
Group	Average Kgs./Ha.	0 Kgs./Ha.	1-80 Kgs./Ha.	81-160 Kgs./Ha.	161-240 Kgs./Ha.	Total
Experimental	128.5	8	10	27	30	75
Spillover	110.9	13	11	29	22	75
Control	104.0	16	12	26	21	75
All Farms	114.5	37	33	82	73	225

Table 2 shows the average yields of farmers in the experimental and control groups (columns (1) and (2)). Separate averages have been calculated for farmers using "low" (0-80 kilograms per hectare), "medium" (81-160), and "high" (161-240) applications of chemical fertilizer (rows (i), (ii), and (iii)). Since maize in Malthusia is sold typically by the 90-kilogram bag, yields in Table 2 are reported in 90-kilogram units. The difference in output per hectare between the experimental and control group farms, for those in each of the three fertilizer categories, is reported in column (3) of Table 2.

Table 2

Differences in Output (90-Kilogram Bags) Per Hectare Between Experimental and Control Group Farms By Fertilizer Use

	(1) Experimental Group		(2) Control Group		(3)=(1)-(2)
Fertilizer Use	Bags/Ha.	(No. of Farms)	Bags/Ha.	(No. of Farms)	Difference in Bags/Ha.
(i) Low (0-80 Kgs./Ha.)	36.8	(18)	34.7	(28)	2.1
(ii) Medium (81-160 Kgs./Ha.)	42.5	(27)	36.3	(26)	6.2
(iii) High (161-240 Kgs./Ha.)	46.3	(30)	37.6	(21)	8.7
(iv) All Farms	42.7	(75)	36.1	(75)	6.6*

* Approximately 80 percent (5.3 bags per hectare) attributable to improved husbandry and 20 percent (1.3 bags per hectare) to increased fertilizer use. See text of paper.

As can be seen in Table 2, substantial increases in production occurred as the result of the NFE courses. Moreover, the difference in average output per hectare between the experimental and control group farms increases with fertilizer use. It appears either that those who used less fertilizer were less able to follow the instructions received in the NFE courses, perhaps because these farmers had had less formal schooling, or that the size of the effect of having adopted the improved management techniques depends on the quantity of fertilizer used. The second explanation implies that neither fertilizer use alone nor good husbandry alone can result in the highest possible yield levels; that, instead, these two aspects of hybrid maize production should be adopted *together*, as a "package."

On the average, across all fertilizer use categories (row (iv) of Table 2), farms that received the NFE courses produced 6.6 bags of maize per hectare more than farms that did not, an impressive difference as we shall see in section V, below. To divide this total effect into two parts, one attributable to the improved practices and the other attributable to the fact that the experimental farms applied more fertilizer per hectare, we need to ask the question: What yields would the experimental farms have obtained *if they had applied fertilizer at the same rates as the farms in the control group*? In other words, what would their average yield have been if 28 (instead of 18) of the experimental farms had applied 0-80 kilograms of fertilizer per hectare, 26 (instead of 27) had applied 81-160 kilograms, and 21 (instead of 30) had applied 161-240 kilograms? Assuming that the average yield within each fertilizer category would have been the same as was in fact observed (36.8, 42.5, and 46.3 bags per hectare), then the average yield across all categories would have been the following: (36.8 x 28 + 42.5 x 26 + 46.3 x 21) divided by 75, or 41.4 bags per hectare. In other words, of the

6.6 bag difference in output per hectare between the experimental and control groups, 5.3 bags (41.4 minus 36.1) is attributable to the improved management techniques taught in the NFE courses and 1.3 bags (42.7 minus 41.4) to the increased use of fertilizer. Put differently, about 80 percent of the 6.6 bag difference is attributable to the first and 20 percent to the second of the two effects.

Table 3 compares the average yield of farmers in the spillover group with that of farmers in the control group and is similar to Table 2. Again, the yields reported in column (1) are larger than the yields reported in column (2), but the differences are much smaller than in Table 2 as we would expect since the spillover effect is what might be called a "second-round" effect. It must be remembered, however, that the production gains on the spillover farms were achieved without any direct investment of government resources. Moreover, for every experimental farm receiving an NFE course, there were many nearby farms not receiving NFE courses yet enjoying production gains. Thus it is quite possible that the total of spillover effects resulting from an NFE course actually exceeds the single direct effect, on the farm receiving the course. This would depend on the number of farms affected by any course, a figure that the experiment does not provide us with.

Table 3

Differences in Output (90-Kilogram Bags) Per Hectare Between Spillover and Control Group Farms By Fertilizer Use

Fertilizer Use	(1) Spillover Group		(2) Control Group		(3)=(1)-(2)
	Bags/Ha.	(No. of Farms)	Bags/Ha	(No. of Farms)	Difference in Bags/Ha.
(i) Low (0-80 Kgs./Ha.)	34.9	(24)	34.7	(28)	0.2
(ii) Medium (81-160 Kgs./Ha.)	37.1	(29)	36.3	(26)	0.8
(iii) High (161-240 Kgs./Ha.)	38.8	(22)	37.6	(21)	1.2
(iv) All Farms	36.9	(75)	36.1	(75)	0.8*

* Approximately 88 percent (0.7 bags per hectare) attributable to improved husbandry and 12 percent (0.1 bags per hectare) to increased fertilizer use.

In conclusion, the NFE program in Malthusia would seem from the results of the experiment to have considerable potential for increasing maize yields and, hence, rural incomes. The experiment for the evaluation of the program has shown that an NFE course can have a large effect (estimated at 5.3 or 6.6 bags per hectare, depending on what is counted) on the farm receiving it and a smaller effect (estimated at 0.7 or 0.8 bags per hectare per farm) on an indeterminate number of neighboring farms. Whether or not the program is "worthwhile" and ought to be expanded depends on the value to Malthusian society of the increased maize output attributable to an NFE course and on the cost to Malthusian society of providing the course. The following section evaluates the program within a benefit-cost framework.

V. Costs and Benefits of the Program

Each NFE course in maize management consists of one full day of instruction provided by one MOA extension agent. Although the course entails inputs other than the instructor's time (for example, the use of a bicycle to get the instructor to and from the farm, perhaps some instructional materials, and certainly the time of various farm members), nevertheless, from the government's point of view at least, the instructor's time is the most important input.

There are many activities that can occupy the time of the MOA extension agent. In teaching the NFE course, the agent necessarily gives up for that day these other, productive activities. The "cost" of the NFE course is the value of what is given up. One measure of this cost, easily obtained, is the agent's daily wage. The current daily wage of an MOA extension agent is 50 Malthees. (The Malthee is the unit of Malthusia's currency.)

On the other side of the evaluation picture, the experiment has identified the following benefits of each NFE course: (1) the additional output on the course recipient's own farm attributable to improved maize management techniques; (2) the additional output on the course recipient's own farm attributable to increased fertilizer use; (3) the additional output on neighboring farms attributable to improved maize management techniques; and (4) the additional output on neighboring farms attributable to increased fertilizer use.

The Malthusian planners have decided to base their final conclusions on the first benefit (1 above) alone. This is a conservative strategy. Because the second and fourth benefits involve an additional social cost (the cost of the extra fertilizer), some people would argue that these should not be lumped simply together with the first benefit. Although the third benefit is clearly attributable to the NFE course, there is no way of knowing at this point how many beneficiaries are involved. Thus, benefit number three will not be included in the benefit-cost calculations. The benefit-cost ratio computed on the basis of the first benefit alone represents a minimum figure for evaluating the NFE program. If the spillover effect, which the experiment has shown exists, could be precisely quantified and included in the calculations, the computed benefit-cost ratio would be larger, perhaps much larger.

The planners have assessed the size of benefit number one to be 5.3 bags per hectare. On the average, a Malthusian farmer plants about 1.5 hectares of maize. Thus the size of benefit number one per NFE course recipient is approximately 8 (= 1.5 x 5.3) bags of maize. The current price of a bag of maize in Malthusia is 125 Malthees (M. 125). Thus the value of the benefit per course recipient is estimated to be M. 1,000, already a very large figure when compared with the cost of providing the course (M. 50 to pay for the instructor).

But this benefit of M. 1,000 applies to the first planting season only. There is no reason to expect that what is learned on a farm in one year will be forgotten by the following year. The planners need to make an assumption about the rate at which knowledge is forgotten from one year to the next. They decide to try two different assumptions, each rather extreme, to see how sensitive are their estimates of benefits over time to such assumptions. First, they will assume that farmers never forget what they know, even from one generation to the next (fathers tell their sons, and the sons tell their sons, and so on). Under this assumption the benefit of M. 1,000 endures ad infinitum. Next, the planners will assume that knowledge is passed on, but imperfectly: 50 percent of what is known in any one year is remembered in the following year (provided there is no new learning or re-learning, say as the result of another NFE course). Under this assumption the benefit of M. 1,000 applies to the first year only; the second year's benefit is M. 500, the third year's M. 250, and so on.

In addition to the question of knowledge retention, there is the problem that the entire cost of the NFE program is incurred in the first year, whereas all of the benefits (with the exception of M. 1,000 in the first year) occur in the future. Money in the future is worth less today than an equivalent amount of money today because money can earn interest (see Section C of the manual). The relevant questions that the planners must ask are the following: What would have happened if the government had not spent M. 50 to provide an NFE course? Where did the M. 50 come from? (Answer: The government taxed individuals in the nation.) At what rate would the M. 50 have earned interest in the private sector if the government had left it there?

To answer the final question (quite a difficult one in practice), the planners can look at the rates of interests now being earned in the private sector. They find that, for the most part, interest rates range from 5 percent (on short-term, low-risk borrowing) to 15 percent (on long-term, high risk ventures). Accordingly, the planners decide to use two rates, 5 percent and 15 percent, for the purpose of discounting the stream of benefits derived from an NFE course.

Table 4 summarizes the results of the benefit-cost analysis.[*] The discounted benefits of an NFE course, presented in column (1), are seen to be quite sensitive to the discount rate used and, even more so, to the assumption made about the retention of knowledge on a farm from one year to the next. Depending on these two factors, the present value of estimated benefits range from a minimum of M. 1,769.23 to a maximum of M. 21,000.00. The "correct" figure may lie somewhere between these two extremes.

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[*] The present values (PV) in column (1) of Table 4 are based on the following equations:

(i) $PV = 1{,}000 + 1{,}000/1.05 + \ldots + 1{,}000/1.05$

(ii) $PV = 1{,}000 + 1{,}000/1.15 + \ldots + 1{,}000/1.15$

(iii) $PV = 1{,}000 + (.5)(1{,}000)/1.05 + \ldots + (.5\quad)(1{,}000)/1.05$

$= 1{,}000 + 1{,}000/2.10 + \ldots + 1{,}000/2.10$

(iv) $PV = 1{,}000 + (.5)(1{,}000)/1.15 + \ldots + (.5\quad)(1{,}000)/1.15$

$= 1{,}000 + 1{,}000/2.30 + \ldots + 1{,}000/2.30$

Using Table 5 in Section C, we find that the solutions to (i) and (ii) are as follows:

(i) $PV = 1{,}000 + 20{,}000 = 21{,}000$

(ii) $PV = 1{,}000 + 6{,}666.67 = 7{,}666.67$

From Table 5 in Section C, we may generalize that:

$$B/(1+r) + \ldots + B/(1+r) \quad = B/r$$

Thus the solutions to (iii) and (iv) are as follows:

(iii) $PV = 1{,}000 + 1{,}000/1.10 = 1{,}909.09$

(iv) $PV = 1{,}000 + 1{,}000/1.30 = 1{,}769.23$

Table 4

Benefits and Costs of One NFE Course Discounting at Different Rates and Using Different Assumptions About the Retention of Knowledge

Annual Retention Rate Annual Discount Rate	(1) Benefits (Malthees)	(2) Costs (Malthees)	(3)=(1)/(2) Benefit-Cost Ratio
Full Retention			
(i) 5 percent	21,000.00	50.00	420.0
(ii) 15 percent	7,666.67	50.00	153.3
Half Retention			
(iii) 5 percent	1,909.09	50.00	38.2
(iv) 15 percent	1,769.23	50.00	35.4

Since the costs of an NFE course are assumed to fall entirely in the initial period, these do not vary with the discount rate (see column (2)). The value today of M. 50.00 today is, of course, M. 50.00.

Column (3) of Table 4 presents the benefits of an NFE course as a proportion of the costs. This ratio, known as the benefit-cost ratio, is a handy indicator of any program's profitability. Clearly 1.0 is the break-even ratio. Any ratio smaller than 1.0 indicates that the costs of the program exceed the benefits. Any ratio larger than 1.0 indicates that the benefits outweigh the costs.

Table 4 suggests that, under any reasonable set of assumptions for valuing benefits, Malthusia's NFE program in hybrid maize management is a profitable one--the benefits exceed the costs. Even under the most stringent assumptions, the benefits outweigh the costs by a factor of 35. Provided that there is no alternative program under consideration with an even higher benefit-cost ratio, the Malthusian planners should choose to expand the program of NFE courses.

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GLOSSARY

Allocation. The allotment of goods, services, or money among specific projects or persons.

Annualization. The distribution of capital costs over the number of years the equipment is expected to last. The cost of capital in each year depends upon depreciation and the social rate of discount (the cost of tying up the capital in the project as opposed to investing it elsewhere).

Average Cost. The total cost of the project divided by the number of units produced.

Baseline Information. Data describing the initial status of project participants and area characteristics prior to the implementation of the project.

Benefit. The value (usually in monetary terms) given a project outcome.

Benefit/Cost Analysis. The assessment and comparison of project benefits and costs in order to determine the profitability of an investment in a specific project or in order to select among project alternatives.

Benefit/Cost Ratio. This ratio gives the discounted present value of the project returns per unit of cost. That is

$$\text{Benefit/Cost Ratio} = \frac{\text{Discounted Present Value of Benefits}}{\text{Discounted Present Value of Costs}}$$

In order for the investment to be recovered the ratio must be 1.0 or greater.

Break-even Point. The point at which the present discounted value of benefits is just equal to the present discounted value of costs.

Capital Costs. A cost that is incurred for goods and services that last more than one accounting period (usually one year).

Compound Interest. Interest which accrues in each year both on the initial investment and on all interest earned from that investment in previous years.

Constant (Dollar) Values. The monetary value of costs and benefits which have been adjusted for inflation by using a price index so that all prices are expressed in the same units.

Cost Analysis. The collection and assessment of information on the costs of the resources required by a project.

Cost/Benefit Analysis. See Benefit/Cost Analysis.

Cost/Benefit Ratio. The inverse of the Benefit/Cost Ratio.

$$\text{Cost/Benefit Ratio} = \frac{\text{Discounted Present Value of Costs}}{\text{Discounted Present Value of Benefits}}$$

In order for the investment to be recovered the ratio must be less than 1.0.

Cost/Effectiveness Analysis. The assessment and comparison of project outcomes and costs to determine the desirability and relative efficiency of various project alternatives or a single project. The logic of this analysis is analogous to that used in benefit/cost analysis, the main difference is that in cost/effectiveness analysis outcomes can not readily be translated into monetary values.

Criteria. Standards on which a judgment or decision may be based.

Current Dollars. The monetary value of a cost or benefit in the year in which it occures.

Database. An organized collection of data from which useful information can be obtained. It consists of information or records about people or things and can be stored in a number of forms.

Depreciation. The decline in the value of a fixed asset due to wear and tear or obsolesence.

Discounted Present Value. The value at the present (or a specified) time of income to be received in future years. This value depends upon the discount rate used in the calculation and the timing of the future income.

Discount Rate. The interest rate which is used to calculate how much a future payment is worth at the present time. Most often the social rate of discount, which represents a judgment about the costs to society of tying up capital in a project rather than investing it elsewhere, is used.

Economic Analysis. The systematic assessment and comparison of the costs and outcomes of a given project (or projects) in order to determine the advisability of investing in the project(s).

Economies of Scale. The decrease in average costs as the scale or size of the project increases.

External Evaluator. An evaluator who is independent of the development and operation of the project and hence can look at the project objectively.

Fixed Costs. Costs which do not vary with the level of output.

Foregone Earnings. Income that is lost as a result of participating or tying up capital in the project.

Foreign Exchange. Currency, checks, drafts and bills of exchange used for international payment. The foreign exchange rate is the price of one currency in relation to another.

Formative Evaluation. Project analysis which is conducted during the course of the project so that the evaluation results can be fed back to project managers in order to improve the project as it goes along.

Fringe Benefits. Benefits received by an employee which are in addition to wages.

Future Value. The value of an investment at a specific point in the future.

Goals. Statements about the desired results from the project. Goals are usually expressed in long-range and broad terms related to overall economic and social development strategies.

Interest Rate. The price paid for the use of money over a period of time. It is stated as an annual percentage of the amount of money borrowed or saved.

Internal Rate of Return. The discount rate at which the discounted present value of benefits is just equal to the discounted present value of costs for the project.

Marginal Cost. The cost of producing one additional unit (i.e., the cost of adding another student or of increasing instructional time by another hour).

Market Price. The price paid or received for goods and services under relatively competitive conditions for buying and selling.

Net Present Value. The present discounted value of benefits less the present discounted value of costs of a project.

Nonformal Education (NFE). Organized educational activities for children and adults which are conducted outside the formal schooling system.

Objectives. Specifically stated short-range outcomes which are expected from the project. Objectives provide a linkage between project operation and the broader development goals of the project and are usually stated in operational terms which allow for some degree of measurement.

Opportunity Cost. The value of the income or goods and services that are lost as a result of using the resource in a certain project rather than in the best alternative.

Real Value. The value of goods and services expressed in prices which have been adjusted for inflation.

Recurrent Costs. Costs which are incurred for goods and services which are used up in the same accounting period in which they are purchased.

Reliability. A reliable measure is one that provides a consistent and stable indication of the characteristic being measured.

SCOPE. Specification of Cost and Outcomes in Project Evaluation.

Sensitivity Analysis. An assessment of the sensitivity of the conclusions of the evaluation to potential errors in the data and assumptions on which the original analysis was based.

Shadow Prices. Prices that would prevail under conditions of perfect competition and in the absence of government regulations and intervention. These prices most often are used to correct for taxes and subsidies, distorted market prices, wages under conditions of serious unemployment, and foreign exchange distortions.

Summative Evaluation. An evaluation which is conducted after a project has been operating for some time to determine and assess the accomplishments and profitability of the project.

Time Horizon. The period of time over which the project's costs and outcomes are to be collected and assessed in an evaluation.

Total Costs. The sum of the costs of all the resources used in a project.

Validity. Validity refers to whether a measurement technique or indicator collects the information that is needed for purposes of an evaluation.

Variable Costs. Costs that vary with the level of output.

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